Review of Food-Borne Trematodiases in the Philippines

Percy G. Balderia[1] and Vicente Y. Belizario, Jr.[1,2]

[1]*National Institutes of Health, University of the Philippines Manila*
[2]*Department of Parasitology, College of Public Health, University of the Philippines Manila*

ABSTRACT

Food-borne trematodes (FBTs) are emerging infections and of substantial public health importance but are among the most ignored of the neglected tropical diseases (NTDs) in terms of attention, research and funding. A review of the status of FBTs in the Philippines based on the best available local and national information may provide a basis for the formulation of appropriate prevention and control measures most suitable for its setting. This review presents a summary of the key features of FBTs and the epidemiologic pattern of FBTs in the Philippines and on the current measures being done for infection control and prevention in other countries. Paragonimiasis, echinostomiasis, and heterophyidiasis are still prevalent in the Philippines with food preparation and hygiene practices and presence of infected intermediate hosts as major determinants of epidemiology and disease burden. Control and prevention of food-borne trematodes may be best achieved with political will, coordinated efforts among responsible public sectors, and involvement of relevant communities.

Key Words: food-borne trematodes, neglected tropical diseases, emerging infections

Introduction

Trematodes are flukes belonging to the phylum Platyhelminthes. Food-borne trematodes (FBTs) include liver flukes (*Fasciola* spp., *Clonorchis sinensis, Opisthorchis* spp.), lung flukes (*Paragonimus* spp.), and intestinal flukes (*Fasciolopsis buski*, *Echinostoma* spp., *Artyfechinostomum* spp., heterophyids).[1,2,3] More than 41 million are estimated as currently infected with FBTs and the number of people at risk globally is 750 million.[4] The diseases representing the most significant threat to human health are: clonorchiasis (infection with *Clonorchis sinensis*), opisthorchiasis (infection with *Opisthorchis viverrini* or *O. felineus*), and fascioliasis (infection with *Fasciola hepatica* or *F. gigantica*), all of which affect the liver and biliary system, and paragonimiasis (infection with *Paragonimus* spp.), which mainly affects the lungs.[5] As the name suggests, these infections are acquired through ingestion of metacercariae from raw or poorly cooked infected hosts such as shellfish, snails, crustaceans, fish, frogs, snakes, and water plants. The distribution of these infections is highly focal, depending on the food habits of people and on the presence of susceptible intermediate hosts.[6]

Changing demographics and the concomitant alterations to the environment and human behavior converge to favor the emergence and spread of FBTs.[7] Advances in transportation allow faster movement of people, bringing with them their local customs and practices, and animals to different places. This also potentially allows for transfer of parasites to previously uninfected areas. The availability of raw or inadequately cooked food from areas where they are considered local delicacies also poses concerns for FBT transmission. Rapid population growth, poverty, and overcrowding may result in the inability to keep pace with the necessary provision of adequate sanitation and clean, safe drinking water, which increases the risk of *Fasciola* infections. Although FBTs are considered emerging infections and of substantial public health importance, these diseases are among the most ignored of the neglected tropical diseases (NTDs) in terms of attention, research and funding.[6,8] Given the large number of people who are infected and who are at risk of infection, the wide geographic distribution, the associated morbidities, and the presence of tools for diagnosis and control of many of these diseases, control and prevention of FBTs should now command far greater attention. However, generalizations about the public health significance of a particular species should be considered with caution.[6] Each country should have its own assessment based on the best available local and national information and draft appropriate prevention and control measures that are most suitable for its setting.

This review presents a summary of the key features of FBTs, including the mode of transmission, pathology, clinical manifestations, and general principles of diagnosis and treatment. Emphasis is placed on the epidemiologic pattern of FBTs in the Philippines and on the current measures being done for infection control and prevention in other countries. Recommendations for the local setting are made.

Corresponding author: Percy G. Balderia, MD
PhilHealth Insurance Corporation
Citystate Centre Building, 709 Shaw Boulevard,
Pasig City 1603 Philippines
Telephone: +632 4417444 local 7586
Email: percybalderia@gmail.com

Methods

A systematic search for articles using the search terms "trematodes", "food-borne trematodes", "paragonimus", "fasciola", "clonorchis", "opisthorchis", "echinostoma", "capillaria", "heterophyid", and "fluke" was done in Pubmed utilizing Medical Subject Headings (MESH). Similar key words were also used in searching the websites of the Department of Health, Centers for Disease Prevention and Control, New England Journal of Medicine, American Journal of Tropical Medicine and Hygiene, and Journal of Tropical Medicine and in the University of the Philippines Manila College of Public Health Library. Articles were read and assessed for inclusion according to their relevance to the authors' objectives.

Review of Food-Borne Trematodes: Life Cycles, Modes of Transmisson, Clinical Manifestations, Diagnosis, Treatment

Life Cycles and Modes of Transmission

FBTs are grouped under the subclass Digenea, which undergo sexual reproduction in definitive hosts and asexual reproduction in aquatic snails, which act as intermediate hosts.[9] Eggs produced by adult worms following sexual reproduction in definitive hosts such as humans are released through the latter's feces, as in most FBTs, or in the sputum (*Paragonimus* spp.). In the presence of appropriate environmental conditions, these eggs hatch into miracidia.[10] These miracidia, attracted by chemokinesis and chemotaxis, enter the body of aquatic snails by being ingested or by penetrating into the hosts' bodies.

Within the snail, asexual reproduction occurs for several weeks, eventually producing sporocysts that develop into cercariae (Figure 1). Cercariae leave the snail intermediate host by either active escape or passive extrusion. Some would encyst on aquatic vegetation such as watercress (e.g., *F. hepatica* and *F. buski*) and water chestnuts, water ferns, and water caltrops (e.g., *F. buski*) while others penetrate the skin of a second intermediate host and encyst in the flesh of fish (e.g., *C. sinensis* and *Opisthorchis* spp.), crustaceans (e.g., *Paragonimus* spp.), or frogs, snails, and tadpoles (e.g., *Echinostoma* spp.).[10] The cercariae transform into metacercariae, which are the infective stage to humans. This process varies from an hour to several months.[10]

Humans and animal hosts become infected after consumption of raw, pickled, or inadequately cooked aquatic products harboring metacercariae or, in the case of *Fasciola* spp., when drinking contaminated water.[11,12] Metacercariae may also contaminate eating and cooking utensils. This mode of transmission may explain cases of paragonimiasis in humans who have no history of eating crustaceans and in certain carnivorous reservoir hosts which are not likely to ingest crabs in the wild.[13]

Clinical Manifestations and Morbidity

FBT infections are characterized by a chronic clinical evolution reflecting the steady accumulation of adult worms in the body through subsequent rounds of infection.[5] Studies have shown that morbidity due to FBT infections is associated with the number of worms.[14] Inflammatory lesions and damage of tissues and organs can occur depending on the worm burden. However, there is still insufficient information about the relation between FBT intensity and morbidity, particularly for infection with heterophyids in humans.[6]

Lung Flukes

The most common symptoms of infection with *Paragonimus* spp. are cough and hemoptysis.[15] Other reported signs and symptoms are chest and back pains, dyspnea, easy fatigability, fever, body weakness, anorexia and weight loss. The reported illness duration ranged from 10 months to 10 years with most of them lasting one to two years.[13] In a study in Vietnam, the manifestations of paragonimiasis patients include cough (100%), interrupted development (97.7%), eosinophilia (90.8%), hemoptysis (90.2%), chest pain (80.3%), pleural effusion (24.6%), fever (8.3%), and neurological symptoms (4.5%).[16]

Adult *Paragonimus* can also rarely migrate into other sites such as skin, liver, eye, abdominal organs, or brain. It has been suggested that aberrant migration is more likely to occur in heavy infections and may be explained by the circuitous route of migration of this parasite. Case reports of ectopic paragonimiasis have been reported in Korea and Japan.[17] Of these ectopic cases, cerebral paragonimiasis is the most severe and may cause cerebral hemorrhage, edema, or eosinophilic meningoencephalitis. The case-fatality is highest among patients with intracranial hypertension.[10]

Liver Flukes

Fascioliasis is caused by the liver flukes, *Fasciola hepatica* and *Fasciola gigantica*. Clinical signs of fascioliasis are caused by the migration of the immature flukes through the liver causing primarily gastrointestinal manifestations. Aberrant migrations of *Fasciola* can also occur.[18] The migratory route of *Fasciola* spp. through the intestinal wall of human hosts to the liver may explain the existence of ectopic fascioliasis. When the parasites have entered the biliary tree in its chronic stages, biliary colic, intermittent jaundice, fatty food intolerance, cholangitis, acute pancreatitis, and cholecystitis may also be seen.[19,20]

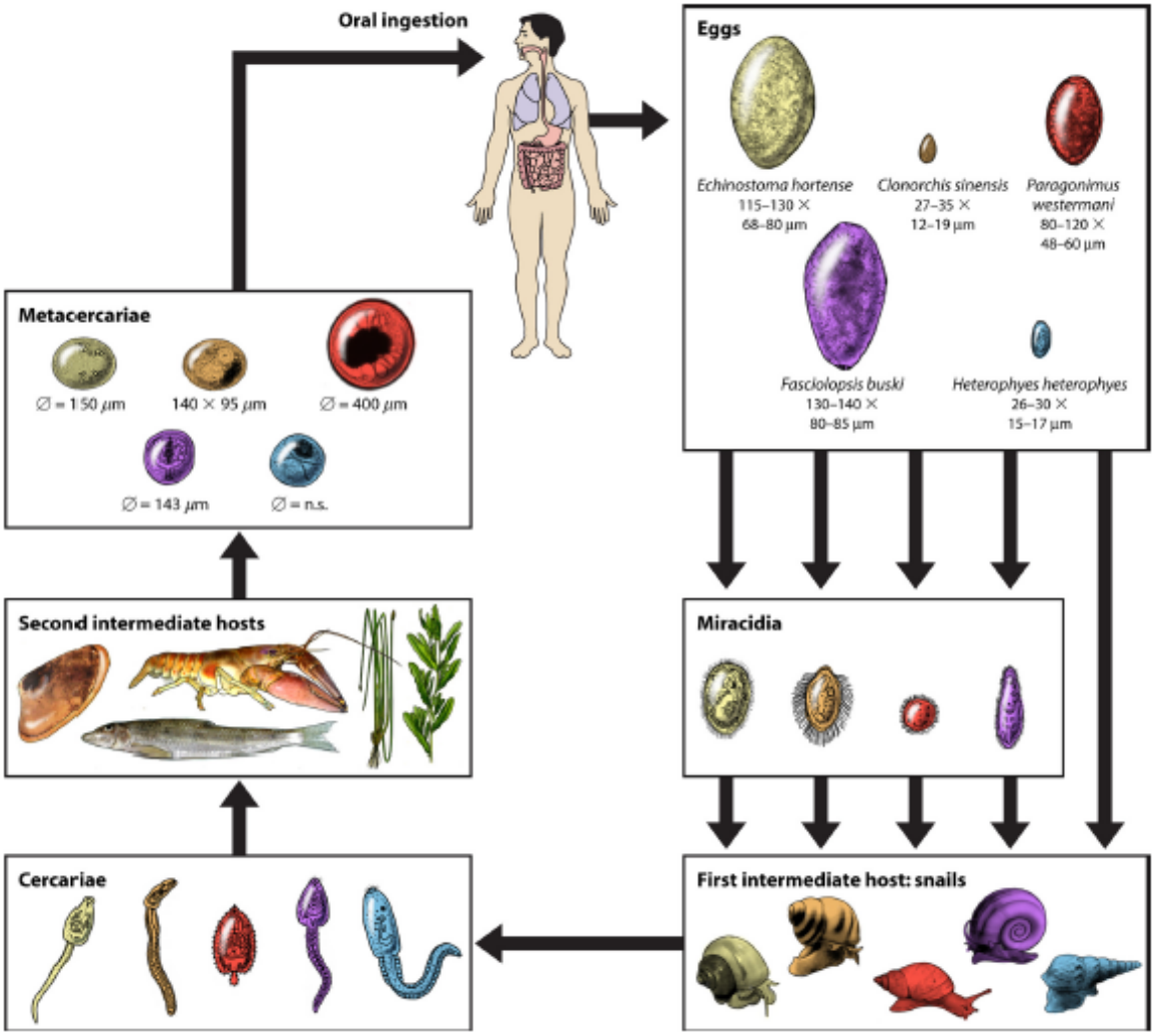

Figure 1. Life Cycle of Food-Borne Trematodes.[10]

Light intensity infections by *C. sinensis* are usually asymptomatic or have few clinical symptoms such as abdominal pain and diarrhea. Moderate parasite loads can result in fever, anorexia, edema, night blindness, swollen abdomen, and hepatomegaly.[10] Invasion of the pancreatic duct occurs in patients with heavy infections. Patients with clonorchiasis also have an increased risk of developing cholangiocarcinoma.[6]

Opisthorchiasis, from infection with *Opisthorchis viverrini* and *O. felineus*, has signs and symptoms that are similar to those described for clonorchiasis. With chronic heavy intensity infections, gallbladder enlargement, cholecystitis, cholangitis, liver abscess, and gall stones can occur. Importantly, the risk of developing cholangiocarcinoma is also increased.[10] This increased risk may be attributed to the presence of chronic inflammation in the biliary tract in opisthorchiasis. Studies found a positive correlation between the endemicity of opisthorchiasis and the frequency of cholangiocarcinoma.[10]

Intestinal Flukes

Like other FBT infections, the severity of symptoms of patients with intestinal flukes may be associated with the parasite load.[19] Light infections with *Fasciolopsis buski* are characterized by mild gastrointestinal disturbances like diarrhea, constipation, abdominal pain, as well as headache and dizziness.[10] In endemic areas where there is a greater risk of heavy infections, morbidity is high and the disease can be fatal.[19] *Echinostoma* infections typically present with abdominal pain, diarrhea, and malaise. Heterophyid infections are usually mild and transient. In patients with heterophyidiasis in San Isidro, Compostela Valley, 45.8% of those who were interviewed complained of peptic ulcer-like symptoms such as abdominal discomfort/pain and a gurgling abdomen.[21] The eggs and sometimes the adult

flukes enter the blood vessels of the intestine and embolize to the brain. They may also enter the mesenteric lymphatics and travel to the heart. Indeed, ectopic heterophyidiasis involving the brain and the heart, resulting in myocardial and valvular damage, has been reported.[22] In an autopsy of 34 cases of heterophyidiasis, 14 have heart lesions, of which 13 were noted to have had cardiac symptoms in life and whose deaths were attributed to heart failure.[23]

Diagnosis

The diagnosis of FBT infections starts with clinical suspicion based on presenting signs and symptoms, travel to endemic areas, and history of consumption of inadequately cooked food or contaminated water. For paragonimiasis, national guidelines recommend that patients with unresolved symptoms, such as chronic cough with or without blood- tinged sputum, in spite of receiving adequate treatment with anti-TB medications or having a negative sputum AFB result be screened.[24] A local study indicated that it is important to consider intestinal fluke infection and the need for a stool examination when dealing with a patient presenting with peptic ulcer disease-like manifestation and a history of possible exposure.[21]

The definitive diagnosis of FBT infections usually relies on the identification of parasite eggs in stool samples of infected human beings. In the case of pulmonary paragonimiasis or infections in ectopic sites, sputum specimen or tissue samples are utilized, respectively. Of the several coprological diagnostic methods, the most widely used techniques are the Kato-Katz and formalin-ethyl-acetate concentration techniques because of the reasonably high sensitivity at the level of moderate and heavy intensity infections and the capacity to quantify infection intensity.[3]

Immunodiagnostic tests have been developed such as intradermal tests, indirect hemagglutination assays, indirect fluorescent antibody tests, and tests based on the indirect enzyme-linked immunosorbent assay.[25] These tests utilize different extracts from parasites and the results can remain positive for several years after successful treatment, hence their inability to distinguish acute from chronic infections. Another important issue is cross-reactivity among the different trematode infections. It is of particular importance to distinguish heterophyid from *Clonorchis* and *Opisthorchis* infections and *Fasciola* from *Fasciolopsis* infections because of differences in treatment. At present, there is still no consensus on the ideal test system or specific antigen to be used in immunodiagnosis.[10]

Polymerase chain reaction (PCR)-based methods have also been developed to improve the detection of FBT infections like loop-mediated isothermal amplification (LAMP) assay.[26] However, PCR-based assays are unlikely to become a routine diagnostic tool in resource-constrained settings at present.[10]

Many FBTs are still overlooked during microscopy of specimen, the most commonly used method to date, because of the lack of familiarity with most trematode infections and inexperience in detecting small eggs.[1] This leads to unreliable prevalence data, underappreciation of public health burden and impact, and neglect with respect to treatment and control.[27] In addition, some eggs are difficult to distinguish by microscopy. Such poor sensitivity of detection may also underestimate the true burden of disease in areas where fecal egg excretion approaches zero. Despite the considerable progress that has been made in terms of diagnosis of FBTs in recent years, there is still a need for further research for tests that are sensitive, specific, reliable, simple and importantly, cost-effective. Also, training of healthcare workers and provision of the necessary technology in resource-constrained settings should be facilitated.

Treatment

Paragonimus spp.

Praziquantel is the drug of choice. The WHO currently recommends praziquantel at a dose of 25 mg/kg given orally three times a day for three days. A short course of corticosteroids may be given with praziquantel to help reduce the inflammatory response around dying flukes in cerebral disease. Although the exact effect of praziquantel on adult *Paragonimus* remains to be elucidated, purported mechanisms include alteration of the tegumental surface and disruption of calcium homeostasis.[28,29] A recent local double-blind, randomized, controlled therapeutic trial concluded that triclabendazole administered at 10 mg/kg single dose has comparable efficacy, safety, and tolerability as praziquantel. [30,31]

Clonorchis and Opisthorchis spp.

The WHO recommends praziquantel 25 mg/kg three times a day for two consecutive days for both diseases. Praziquantel exhibits high efficacy against trematodes by inducing rapid vacuolization and disintegration of the tegument of the parasites.[32,33]

Fasciola spp.

Triclabendazole is recommended by the WHO at a single dose of 10 mg/kg. It has been speculated that triclabendazole bind to the parasites' ß-tubulins, which leads to depolymerization and disruption of microtubule-based process.[34] Bithionol can also be used for fascioliasis if triclabendazole is not available.[10]

Intestinal Flukes

Praziquantel given 75 mg/kg/day divided in 3 doses for one day is the treatment of choice.[35,36] Ectopic cases are treated similarly.

Access to nontoxic, well-tolerated, orally-active and inexpensive trematocidal drugs, ideally exhibiting a high therapeutic efficacy following a single dose, is a key factor for individual treatment, and particularly for large-scale community-based morbidity control of FBTs.[37] However, there is no drug at present that satisfies all the abovementioned criteria. Moreover, the paucity of presently available drugs raises concern regarding possible development of resistance. In addition, as FBT infections disproportionately occur among poor people living in developing countries, access to new drugs may be difficult. There is also less impetus for research to produce new drugs because of the relatively small market present for anti-FBTs in industrialized countries.

Recommended guidelines may be beneficial to address the gaps between industrialized and developing countries in terms of drug development and provision. At present, optimization of the use of presently available drugs by ensuring quality (e.g. bioequivalence of different brands) and provision of adequate treatment to infected people are hoped to aid greatly in prevention and control of FBTs in developing countries.

Epidemiology of Food-Borne Trematode Infections in the Philippines

Food-borne trematodes have been documented in the Philippines since the early 1900s.[38] After more than a century, paragonimiasis, echinostomiasis, and heterophyidiasis are still prevalent in certain areas of the Philippines.[31] While pollution, poverty, and population growth are frequently described as major determinants of the epidemiology and disease burden of food- and water-borne parasitic diseases, most studies on the epidemiology of FBTs in the Philippines identify local hygiene and food preparation practices and presence of infected intermediate hosts in the community as the predominant factors involved in transmission of these diseases.[31] However, the contribution of pollution, population growth, and poverty, as well as overcrowding, on FBT transmission cannot be ignored for their effects on sanitation and adequate provision of food and safe, clean drinking water.

Paragonimiasis

Paragonimus westermani was discovered in the Philippines in 1907 by Musgrave who reported 17 cases and subsequently observed by Garrison in 1908 among inmates of the National Penitentiary.[38,39] In 1986, incidental findings of suspected *P. westermani* ova were detected in the sputum of 49 individuals from the municipalities of Irosin and Bulusan in Sorsogon who presented with tuberculosis-like symptoms.[38] Moreover, a study in 1973 showed that 14 of the 16 municipalities in Sorsogon demonstrated the presence of the crab intermediate host *Sundathelphusa philippina*.[39] The highest rates of metacercariae-positive crabs at 53% were found in the municipalities of Juban, Casiguran, Bulan, and Magallanes.[40]

The most common methods of preparation of *S. philippina* being eaten in identified endemic areas are "kinilaw" and "kinagang".[41] "Kinilaw" is prepared by adding "calamansi" juice and coconut milk to edible portions of the raw crab. On the other hand, "kinagang" involves chopping raw crabs into small pieces. The crab juice is then squeezed, into which grated coconut meat is added. The mixture is then wrapped with leaf and is then boiled to dry. "Kinilaw" may be the more likely cause of transmission of paragonimiasis because of ingestion of raw crab meat.

Because *S. philippina* is adapted to clear, cool, fast-flowing mountain streams, *Paragonimus* infections can only persist in places with mountainous areas and in its immediate surroundings.[41] Currently known endemic areas include Leyte, Sorsogon, Mindoro, Samar, Compostela Valley, Cotabato, Zamboanga del Norte, and Davao Oriental. In Cateel, Davao Oriental, a lung fluke infection rate of 15% was reported.[42] Pulmonary paragonimiasis has been described in patients diagnosed with pulmonary tuberculosis who are not responding to treatment and among patients suspected to have PTB in Sorsogon, with infection rates of 16 to 25%[13] and more recently, 19% in a follow-up study in 2000.

Echinostomiasis

Until the year 1983, no more than around 60 cases of *E. ilocanum* infections had been diagnosed in the Philippines.[39] In a study published in 1986, *E. ilocanum* was found in 3% of over 30,000 stools in a nationwide survey.[43] Rates as high as 44% were found in Ilocano populations of northern Luzon in the same study. In these areas, consumption of uncooked *Pila luzonica* snails is a prevalent practice.[43] In a later survey in Isabela, a similar habit of ingesting of raw or undercooked *Lymnaea (Bullastra) cumingiana*, locally known as "birabid" was common among patients infected with another species of *Echinostoma*, *E. malayanum*.[44] In 2005, the first reported cases of *E. malayanum* in southern Philippines involved three out of 70 adult patients who were previously identified to have fasciolid infections.[45] Nothing is known about the influence of geofactors in the distribution of these intestinal flukes.[39]

Fascioliasis

In aggregate, no more than 5 cases of human fascioliasis have so far been detected in the Philippines until 1985.[39] Although it has been confirmed that *F. gigantica* is present in the Philippines, there has been some uncertainty as to whether *F. hepatica* is present in the country.[46] However, cases of the latter have still been reported.[47] A review in 2008 noted the lack of current epidemiologic data on the prevalence, type, or distribution of fascioliasis in the Philippines.[46]

Heterophyidiasis

In a series of 297 autopsies in Manila City morgue serving the Philippine General Hospital in 1935, 34 cases (11%) of various heterophyid infections were recorded.[48] Among the species noted were *Haplorchis taichui, H. vanissima, P. calderoni, H. taihoku, H. yokogawai,* and *D. pseudocirrata*.[48] In other early studies, there were 3% and less than 1% recorded infections in Negros Oriental and in Bukidnon, respectively.[49,50] In a follow-up study done in Negros Oriental, 24 (22.4%) out of 107 family members of previously diagnosed patients were found to be also positive for heterophyid ova in stool samples.[51] In a later study done nationwide, less than one percent were found positive for heterophyid ova from more than 30,000 stools examined.[49] More recent community surveys done in 1998 and 1999 in Monkayo, Compostela Valley in connection with an outbreak of intestinal capillariasis showed heterophyid infection rates of 16.7% and 15.7%, respectively.[52] In a study in 2000, an even higher infection rate of 36.0% was detected among residents with history of abdominal discomfort and/or diarrhea in the past 4 weeks prior to the survey.[21] This may indicate underreporting of the condition probably due to lack of consideration by clinicians and a lack of recognition in diagnostic laboratories. In the 2000 survey, heterophyidiasis affected patients from all age groups.[21] A recent study cited high rates of infection of 17% and 16% in two villages in Mindanao.[1] The infection has been linked to consumption of raw or undercooked freshwater fish like "tilapia" (*Oreochromis* sp.), "paitan" (*Hypophthalmichthys molitrix*), "dalag" (*Ophiocephalus striatus*), and "buriring" (*Poecilia* sp.), which may have been infected with metacercariae.

Studies on the prevalence among intermediate hosts are very few.[39] A study in 1973 showed about 1% of the snail *Melania juncea* to be infected with cercariae of *H. taichui*.[53] Another study in 1938 showed that 50.2% of fishes from three different species (*Ophicephalus striatus* or "aruan", *Puntius binotatus* or "pait", and *Puntius palata* or "kandar") harbor metacercariae.[54] However, the relevance of these studies must be carefully evaluated in light of the present distribution of intermediate hosts. This presents an opportunity to identify the prevalence of heterophyids among intermediate hosts in identified areas of endemicity.

National Policies for Control of Food-Borne Trematode Infections

The Department of Health (DOH) established the Food and Waterborne Disease Prevention and Control Program in 1997 which became fully operational in the year 2000.[55] This program focuses on food-borne emerging diseases like paragonimiasis as well as cholera, typhoid fever, and hepatitis A. It also covers other illnesses acquired through consumption of contaminated food and water that are not addressed by other services. Although the DOH recognizes the studies done by independent researchers, there is still a lack of nationwide surveys to assess the overall epidemiology of food-borne trematode infections in the country. In addition, health facilities typically treat FBT infections on an individual basis as opposed to mass drug administration.[46]

Recently, DOH has released administrative order (AO) 2010-0037 which contains recommendations for the diagnosis and treatment of paragonimiasis in the Philippines as well as the roles and responsibilities of the National Center for Disease Prevention and Control (NCDPC), local government units (LGUs) and the Center for Health Development to prevent and control the disease.

The DOH has already initiated programs for the control and prevention of FBTs in the country. However, baseline data regarding the burden of FBTs in the country is still wanting. Nationwide surveys are helpful in mapping out areas of endemicity and in re-evaluating the status of previously known endemic regions. Data gathered from such surveys will be useful in directing constrained resources to more appropriate programs and locations. Also, the department should encourage more studies in order to identify the most sensitive, specific, cost-effective, and appropriate diagnostic tests and medications. The diagnostic tests should utilize kits that can be made readily available to rural health units, can be stored for long periods of time, are easily transported, can withstand conditions of transport to far-flung areas, and have quick results that are reliable, accurate, and easily interpreted by barangay health workers with minimal inter-observer variability. Partnerships with local government units, the Department of Education (DepEd), academic institutions, and the private sector should be strengthened for a more concerted effort towards prevention and control of FBTs in the country. The impact of recommendations made by the DOH should also be evaluated so that necessary revisions may be identified and constructed. The evaluation of programs should look at infection rates, distribution of heavy intensity infections, detection rates of symptomatic patients presenting in barangay health centers, and changes in food preparation and hygiene practices and health-seeking behavior of involved communities.

Prevention and Control of Food-Borne Trematode Infections in Other Asian Countries

Some of our neighboring countries have demonstrated successes in terms of prevention and control of FBTs. Their programs include, but are not limited to, capacity building, improvement of living standards, provision of mass drug administration, and periodic surveys in identified areas of endemicity. This review gives a glimpse of the said programs to offer examples as basis for local recommendations.

In China, an integrated control program for parasitic diseases including FBTs was set up. This involves training of health workers and surveillance of infections in regions that are high-risk for parasitic diseases. In a study, the decline in rates of clonorchiasis was associated with improvement in living standards.[56] This was thought to contribute towards increased consumption of large culture fish which are not infected with metacercaria and disinclination to eat fish caught from polluted rivers.

Between 1984 to 1990, treatment with praziquantel was given to more than 3 million people who tested positive for clonorchiasis in endemic areas in Korea.[46] This program, together with mechanization of agriculture, industrialization, and programs directed against water pollution are thought to block the reinfection cycle of *Clonorchis sinensis* in affected areas.[57]

In Lao People's Democratic Republic, health education and MDA with praziquantel are provided free of charge in areas endemic to opistorchiasis with the frequency depending on the prevalence of infection. This MDA also aims to reduce paragonimiasis transmission rates. Moreover, health personnel are periodically trained to recognize FBT infections. Periodic surveys are also conducted to monitor the prevalence rates of FBT infections and to identify the need for modifications in control strategies.[58]

In Vietnam, it has been recommended to administer praziquantel to all people with a history of consumption of raw fish in districts where the prevalence of liver fluke infection is at least 10%.[59] The Ministry of Health (MOH) also developed case management guidelines for human fascioliasis in 2006, provided triclabendazole to diagnosed patients, and trained health personnel in endemic areas in the recognition and treatment of fascioliasis.[60] The greatest impediment in Vietnam's program against fascioliasis is the shortage of triclabendazole tablets. For paragonimiasis, the MOH of Vietnam recommends a standard treatment of 40 mg/kg of praziquantel over two days and treatment targeted to all early infections.[61]

In Thailand, the control of liver flukes includes stool examination and treatment of positive cases with praziquantel, health education for promotion of cooked fish consumption to prevent infection, and improvement of hygienic defecation for interruption of disease transmission. After the control program was launched in 1989, the annual positive rates have subsequently decreased to 9.4% in 2001 from 35.6% in 1988.[62]

Preventive Chemotherapy

The WHO has advocated preventive chemotherapy for lymphatic filariasis, onchocerciasis, schistosomiasis, and soil-transmitted helminthiasis (STH). Preventive chemotherapy entails early and regular administration of antihelminthic drugs to reduce the occurrence, extent, severity, and morbidity associated with these diseases and may also contribute to reduced rates of transmission. Similarly, populations affected with food-borne trematodiasis are also in urgent need of regular treatment.[63] However, more evidence is still needed about the impact of drugs on morbidity before treatment schedules can be recommended for preventive chemotherapy.[63]

Recommendations

Food-borne trematodiases are emerging infections that are of public health significance in the Philippines. Despite this situation, data on prevalence and morbidity are still inadequate. It is important to have baseline data on the burden of FBTs in order to direct resources to the appropriate areas and at-risk population groups and identify the most appropriate control programs. It will also help in the future evaluation of control programs. This calls for baseline sentinel or national surveys to map out areas of endemicity and follow-up studies to reassess the situation in known endemic regions. This may start with putting emphasis on the identification and mandatory reporting of cases of food-borne trematode infections among patients presenting in local health centers. Surveillance can then be done among residents from the same area, identifying cases as well as factors contributing to transmission and re-infection among the subjects.

Since the FBT infections are associated with poverty, overcrowding, poor sanitary conditions, and lack of education, an integrated approach may be the most effective means of prevention and control. The DOH may need to spearhead activities through its Food and Waterborne Disease Prevention and Control Program. Health professionals in endemic areas should be educated on the presenting signs and symptoms of FBTs and on the appropriate diagnostic methods and treatment through capacity building programs. The local government units (LGUs) may be given the responsibility to monitor the implementation of existing prevention and control programs in their respective areas. LGUs can also survey their respective municipalities, aiming to address concerns in housing, infrastructure, sanitation, and source of safe, clean, drinking water. Rural health units may be tasked to report on the progress in terms of diagnostic and cure rates. Barangay health workers can help identify local hygienic and food preparation practices that may contribute to FBT transmission. Through the abovementioned recommendations, the respective local health systems are expected to assume an active role in prevention and control measures in their respective areas of responsibility. Since measures such as prevention of contamination of food through environmental control, hygienic aquaculture, and elimination of the intermediate hosts are impractical, it is important to concentrate on measures aimed at inactivation of metacercarie in food such as adequate heat treatment and freezing.[64] Extensive use of mass media and public health

education are necessary to awaken the awareness of the people to the potential hazards associated with their traditional eating habits.[44] The DepEd may be involved by including in their local curriculum certain topics on food-borne trematodes for schoolchildren living in endemic areas. Although food-related behavior is difficult to change, community involvement based on clear perceptions of benefits can facilitate success. Legislation can help in certain aspects of control efforts but cannot replace voluntary compliance induced by health education.[64]

Control and prevention of food-borne trematodes may be best achieved with political will, coordinated efforts among responsible public sectors, and involvement of relevant communities.

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