

DETERMINANTS OF *ECHINOSTOMIASIS* IN BARANGAY NEW SIBONGA, NABUNTURAN, COMPOSTELA VALLEY PROVINCE

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The study aimed to describe a new focus of Echinostoma infection in the Philippines and its determinants in Barangay New Sibonga, Nabunturan, Compostela Valley Province. Identifying the demographic profile (age, gender, and family income) and eating habits (food preferences, methods of food preparation and handling, and cooking practices) comprised the guidelines for conducting this study.

A mass stool survey was carried out in the study area. Residents of the 8 puroks were requested to submit stool samples. Environmental factors were studied using ocular inspection, as well as key informant interviews and focus group discussions (FGDs) with health workers and residents of the barangay. The survey showed that, out of 210 stool samples collected and examined using Kato-Katz technique, 10 (4.8%) stool samples were found to contain Echinostoma eggs, 20 (9.52%) stool samples were found to contain heterophyid eggs, and 109 (51.9%) stool samples were found to contain soil-transmitted helminthes eggs.

This study reports Barangay New Sibonga, Nabunturan, Compostela Valley Province as a new focus for echinostomiasis in the Philippines. In the study population, echinostomiasis occurs in all age groups, the highest egg-positivity rate was seen in age group 15-19 (6.7%). Both male and female populations were affected with a greater percentage among males (7.2%) than females (2%) infected. Fishes and snails constitute the major food diet in the study area to which the residents obtain from the nearby rice fields and fish ponds. Local residents revealed that these food items are either served half-cooked or eaten raw as kinilaw and sinugba.

The results of this study illustrate the recognition of the possible problem of echinostomiasis, the need for accurate laboratory diagnosis, and the collection of basic epidemiological data that are fundamental in the control and prevention of this health problem at the community and local health system levels.

Keywords: *Echinostomiasis, heterophyidiasis, STH, metacercariae, eating habits, demographic profile*

Introduction

Food-borne parasitic diseases are a global public health, social and economic threat that affect millions of people, and cause enormous suffering, particularly among poor and vulnerable groups in developing countries. While 700 million people around the world are at risk of food-borne trematode infections (FBT), 40-50 million people are

infected with one or more parasites (World Health Organization [WHO] and Food and Agriculture Organization [FAO] Joint Convention, 2002).

The WHO meeting on FBT published in the WHO Technical Research Series No. 849 emphasized the public health importance of these parasitoses. It reviewed many of the trematode diseases in humans with emphasis on liver parasitoses such as *opisthorchiasis*, *clonorchiasis*, and *fascioliasis*; lung parasitosis such as *paragonimiasis*; and intestinal parasitoses like *fasciolopsiasis*, *heterophydisiasis*, *metagonimiasis*, and *echinostomiasis*.

The relationship between diseases caused by trematodes and proximity to human habitation to suitable freshwater bodies was studied. Residents living near freshwater bodies have a 2.15-fold higher risk (95% confidence interval 1.38-3.36) for infections than persons living farther from the water. Exponential growth of aquaculture may be the most important risk factor for the emergence of food-borne *trematodiasis*. This is supported by reviewing aquaculture development in countries endemic for food-borne *trematodiasis* over the past 10-50 years (Keiser & Utzinger, 2005).

There are probably over 2 million people estimated to have intestinal infections. One of the most common yet forgotten, if not underreported, intestinal parasitic infection is *echinostomiasis* (Graczyk & Fried, 1998). It is a food-borne, zoonotic, snail-mediated parasitosis caused by distomate digenean trematodes mainly of the genus *Echinostoma*. The flukes are small, measuring 3-10 mm in length and 1-3 mm in width, with a large ventral sucker and distinctive collar of spines surrounding an oral sucker (Huffman & Fried, 1990).

Adult *echinostome* infect a variety of mammals and aquatic birds. Humans can acquire *echinostome* infection by eating raw or half-cooked mollusks, fish, crustaceans, and amphibians (e.g. tadpoles, frogs) carrying the infective metacercarial stage. These food items constitute a substantial portion of the diet in endemic areas.

Human infection is attributed to at least 16 different species. It is endemic in Southeast Asia and the Far East. Affected countries include Indonesia, Thailand, Taiwan, China, Malaysia, Singapore, Korea, Japan, India, and the Philippines (Graczyk & Fried, 1998).

In Indonesia, human *echinostomiasis* occurs with an average prevalence of 1 percent (Carney, 1991). Eating raw or insufficiently cooked lake mollusks was a common practice (Carney, Sudomo, & Purnomo, 1990). More than 50 percent of stool samples collected in Northern Thailand tested positive for *echinostomes* eggs. Eating raw snails and tadpoles was identified as the mode of transmission. The infection is particularly prevalent in rural Thai women of child-bearing age (Sornmani, 1969). The prevalence of human infections varied from 11 to 65 percent in Taiwan (Lu, 1982), while in China, an average prevalence of 5 percent was reported from the Fujian and Guangdong provinces (Carney, 1991; Li, 1991). Freshwater bivalves, snails, and fish were identified as sources of infection. *Corbicula* clams are eaten raw. Other mollusks are pickled overnight which does not alter the infectivity of *metacercariae*. Throughout Southeast Asia, the common practice of using night soil for fertilization of fish ponds is the primary mode of transmission (Li, 1991). In Korea, human infection ranged from 9-22.4 percent (Graczyk & Fried, 1998).

Echinostome infection is regarded as an intestinal parasite of little clinical importance except in heavy infections (Carney, 1991). A reported case of human

echinostomiasis showed ulcerative lesions on the duodenal mucosa in Korea. A 55-year old man complained of epigastric pain with *hematemesis* in April 1994. Endoscopy revealed lesions of early gastric cancer and duodenal ulcerations. The lesions were evidently made by the parasite which progressed to induce bleeding and hunger pain. The mucosal defect made by the worm may cause luminal bleeding, and be a focus of secondary bacterial infection. Also, the ulcer can be a route of the worm or eggs spreading into the submucosa or extraintestinal location. With the use of endoscopic forceps, two trematode worms were recovered from the lesions which were eventually identified as *Echinostoma hortense*. Through an interview, it was learned that the patient enjoyed eating various raw freshwater fish (Chai, Lee, Lee, & Min, 1994).

This case may be the first report of ulcerative lesions on the duodenum in *echinostomiasis*. It evidently presents the dramatic changes of how far this fluke could cause destruction in the human body. Thus, programs designed to change eating habits are absolutely necessary to stop transmission. This, however, is more easily said than done.

In the Philippines, two *echinostome* species (*E. ilocanum* and *E. malanayanum*) infect humans with an overall prevalence of 3 percent (Cross & Basaca-Sevilla, 1984; Eduardo, 1991). In Northern Luzon, the prevalence of *echinostome* infection among Ilocanos averages 11 percent reaching up to 44 percent in some areas (Cross & Basaca-Sevilla, 1984). Consumption of freshwater snails such as *Pila luzonica* (large rice field snail), *Vivipara angiolaris* and fish as *kilawen* was incriminated as the main mode of *echinostome* transmission. In the country, humans also acquire this infection by eating raw snails (*Lymnaea cumingiana* and *Pila luzonica*), fish, and tadpoles, bagoong (a raw or salted preparation). Infections with these flukes follow a familial trend as methods of food preparation and eating habits are passed from one generation to the next (Graczyk & Fried, 1998).

The northern Luzon region has been reported to be endemic for *echinostomiasis* though sporadic cases have been reported in the islands of Visayas and Mindanao. In one of the mass stool examinations conducted by the University of the Philippines (UP) College of Public Health, in collaboration with the Department of Health (DOH) in Barangay New Sibonga, Nabunturan, Compostela Valley Province, two stool samples from preschool-age children were identified to have eggs of *echinostoma* species. Local medical technologists of the municipality observed those eggs several times in their mass stool examination, yet it was only after the confirmation of the UP Professor, Winifreda de Leon that the *echinostoma* ova were recognized. Hence, the infection was reported for the first time after this event.

Upon ocular inspection of the said area, abundant fresh bodies of water were seen like river, which is the main source of the *barangay's* irrigation schemes, rice fields, fish ponds, large canals, and creeks. Likewise, records from the local government unit (LGU) revealed that the place is under the aquaculture support program of the Department of Agriculture. Records from the *barangay* health center (2004) revealed that in cases of food-borne trematode infections were reported such as *heterophyidiasis*, *capillariasis*, *metagonimiasis*, along with soil-transmitted *helminthiasis*. It is of particular interest to investigate whether the recent rapid development in aquaculture production has resulted in increased risks for human infections with food-borne *trematodiasis* (Keiser & Utzinger, 2005). Concerns have been raised that, this increase might also lead to more

human infections not only in the *barangay* but also in the whole province. Thus, the place was considered for study.

One important epidemiological event happened in the year 2000 also in the province of Compostela Valley. It can be remembered that Monkayo, a municipality of the province, was a new endemic focus for *Capillaria philippinensis*, a food-borne infection acquired from eating raw or improperly cooked fish. A local medical technologist suspected the stool specimen of a 20 year old female complaining of chronic diarrhea, *borborygmi*, bipedal edema, anorexia, and weight loss to be having the said infection. The specimen was forwarded to the Diagnostic Parasitology Laboratory of the College of Public Health at UP in Manila. It was found to be positive for *Capillaria philippinensis* adults, larvae, and eggs. Twelve deaths among people coming from the same *barangay* were affected by a similar illness with no definite diagnosis except “gastroenteritis.” These prompted the DOH central office to send a team that would investigate the factors affecting the occurrence of the disease outbreak labeled as a “mystery disease.” Ocular inspection, interviews, and FGDs revealed that the people’s eating habits were not much different from the habits of those from Ilocos provinces where *capillariasis* was initially described. In both areas, people are fond of eating *kinilaw*, as well as raw shrimps, crabs, and snails. Furthermore, the people defecate in the field or in the same body of water where fishes, shrimps, crabs, and snails for consumption came from, thus completing the life cycle of *Capillaria philippinensis*. Migratory fish-eating birds were likely to have spread this parasite to the area. This is the first report of *capillariasis* outbreak in Compostela Valley province (Belizario, de Leon, Esparar, Galang, Fantone, & Verdadero, 2000).

While it is true that the WHO control programs operate through the essential components of diagnosis, treatment, and prevention for controlling human zoonotic trematodiasis, there have not been any successful programs yet against *echinostomiasis*. This is because *echinostomes* have a much broader second intermediate host range. A wide variety of animals, that is, snails, bivalves, crustaceans, fish, and amphibians serves as second intermediate hosts for *echinostomes* (Huffman & Fried, 1990). In other FBTs, a second intermediate host is either lacking, or represents a single group of organisms. If transmission of *trematodiasis* is going through a single group of hosts, it is relatively easy to interrupt the life cycle, and with proper diagnosis and treatment eliminate the disease from humans.

In the case of *echinostomiasis*, even with control programs that are successfully implemented and sustained by a community, the pathogens still remain in the reservoir hosts due to the sylvatic life cycle, which has common zoonotic potential (Carney et al., 1990; Carney, 1991). A study on Korean soldiers stationed in the foci of *echinostome* transmission revealed that these parasites are capable of reinfecting human population (Huh, Lee, & Huh, 1994). Reservoirs of the pathogens include a wide variety of domesticated and wild mammals and birds, and basically all aquatic organisms that sustain the first and the second intermediate hosts occur in a particular endemic area (Huffman & Fried, 1990).

Human infection of *echinostomes* can be prevented by appropriate changes in diet and food preparation, including thorough cooking of food and giving up the habit of eating raw aquatic animals. Changing of eating habits should be implemented together with more aggressive health education campaigns in endemic areas. This is because the

residents in most endemic areas consider that cooking of food destroys flavor and nutritional value (WHO, 1995; Eduardo, 1991). The need to have a total understanding of the biology of the parasite and the epidemiology of parasitic infection are important. Cultural habits of the people in endemic places must be understood. Upgrading of the laboratory diagnosticians' proficiency seemingly is essential. However, all of these strategies will just be in vain unless prevalence, distribution, extent, and intensities of human infection are known.

Local data show that cases of *echinostomiasis* in the Philippines are not well documented. *Echinostomiasis* is a public health problem but apparently may have been neglected. The study on factors contributory to its occurrence is vital for assessing the magnitude of its public health problem for planning, implementing, monitoring, and sustaining prevention and control activities.

Methods

The study was conducted in Barangay New Sibonga, Nabunturan, Compostela Valley Province. The *barangay* is composed of 8 *puroks* with a total of 241 households. Intestinal parasitism is one of the leading causes of morbidity in the area. In October 2004, along with soil-transmitted *helminthiasis* (STH), cases of *heterophyidiasis*, *capillariasis*, and *schistosomiasis* were reported among the pre-school age children of the *barangay* (New Sibonga Brgy. Health Center record, 2004). *Ascaris* was the most common identified helminth followed by *Trichuris* and hookworm. Local residents usually collect freshwater fishes, snails, crabs, and frogs from the nearby rice fields and fishponds for food consumption.

Descriptive-survey research design was used in this study. This helped describe and interpret the prevailing conditions in the research area and assess the characteristics of the population that are possibly related to the occurrence of *echinostomiasis* and other parasitic infection like demographic profile, annual family income, and eating habits of the local residents. Total enumeration or census sampling technique, in which all the residents of the *barangay* were invited to be respondents of the study. A researcher-constructed questionnaire was used in order to obtain pertinent data. Questions were refined to suit the level of understanding of the respondents.

Personal communication and ocular inspection of the research locale was done before the conduct of the study. The study coordinated with the LGUs for their cooperation and recommendation to gain their consent.

After gaining permission from the local government, houses of the respondents were visited to solicit their consent. Stool sample containers were given to the household to be scheduled for the collection of the stool specimen. After samples were collected, these were brought to the *barangay* health center by the Barangay Health Workers (BHWs) or by the respondents themselves. Specimens were processed by the BHW volunteers and were examined using Kato-Katz thick smear. Each smear contains 4.17mg of fecal sample using a 6mm hole on a 1.5 mm thick template. Slides were read after 1 hour as the period between 30 and 60 minutes was reported to be the optimal clearing time for thick fecal smears containing hookworm eggs at temperatures between 24 and 30°C. Number of eggs was not counted, but slides were recorded as positives or negatives for the different helminths. Apart from trematode eggs, the sample was also

examined for STH and cestode eggs. Kato-katz slides suspected to have *echinostoma* eggs were sent to the local trained microscopist of the Regional Health Unit of Compostela Valley Province for cross-checking.

In the presence of a volunteer physician, respondents found to be positive for parasitic infections, and both soil-transmitted helminths and trematodes, were given appropriate anti-helminthic, albendazole (400 mg in single oral dose) and praziquantel (25 mg/kg body weight), respectively. Anti-helminthics were solicited from the DOH Regional Office. Only one from among the 10 who were diagnosed to have *echinostomiasis* gave consent to be part of the adult fluke collection of *Echinostoma*. Reason for refusal was unavailability due to work, as well as finding the procedure embarrassing and uncomfortable. The patient was requested to have a soft diet the day before the administration of Praziquantel. In the morning, prior to the administration of Praziquantel, dulcolax suppository was inserted into the rectum of the patient. To promote bowel movements on the patient, MgSO₄ was given 30 minutes after the administration of praziquantel. The entire stool movement for that day were collected and pooled individually. The stools were then washed several times in 10 volumes of water, sieved with 2 mm mesh, and resuspended in water. After 10 minutes, the upper layer was discarded, and the lower dark layer was fixed with AFA (ethyl alcohol, formalin, 3% acetic acid). The sample was transported to the research laboratory of San Pedro College, Davao City for the recovery of adult fluke using a stereoscope.

Results and Discussions

Out of the 1,154 inhabitants of Barangay New Sibonga, Nabunturan, Compostela Valley Province, only 210 (18.2%) individuals voluntarily submitted their fecal specimens for examination, one specimen from each person, from the eight *puroks* of Barangay New Sibonga, Nabunturan, Compostela Valley Province, during the month of November, 2005. Reasons for non-response included refusal, lost to follow-up, and failure to defecate on the scheduled date of the stool exam. However, all age groups were represented, with the majority of study participants coming from age groups 49 years and below. Male and female genders were approximately equal. The annual income bracket of most respondents falls within Php 30,000 to 39,000, or around Php 2,500 per month. Meanwhile, no respondent earns a monthly income of Php 7,000 and above. This depicts that the *barangay* is a low income community which may affect their access to education, health, clean water supply, food, and nutrition.

The overall egg- positivity rate for *Echinostoma sp.* was 4.8 percent (10 cases). The *echinostome* eggs observed were bright yellow, elliptical, thin shelled with a shallow operculum, and measured 115 µm (112-118 µm) long and 74.2 µm (71.3-77.1) wide. *Heterophyid* infection was also found in 20 (9.5%) of the respondents. Observed eggs appear to be small, light brown in color, ovoid in shape, operculated and measures 22 µm by 18 µm. Aside from *echinostomiasis* and *heterophyidiasis*, one (0.48%) of the respondents was positive for *schistosomiasis*.

Table 1

Intestinal Parasite Infection Rates Using Kato-Katz Technique Brgy. New Sibonga, Nabunturan, Compostela Valley Province, 5-7 November 2005 (n=210)

Parasite/ Organism	No. of (+) Stool Samples	%
Trematodes	31	
<i>Echinostoma</i>	10	4.8
<i>Heterophyid</i>	20	9.5
<i>Schistosoma japonicum</i>	1	0.48
Soil-transmitted helminthes (STH)	109	
<i>Ascaris lumbricoides</i> alone	7	3.3
<i>Trichuris trichiura</i> alone	5	2.4
Hookworm alone	5	2.4
<i>Ascaris</i> and <i>Trichuris</i>	40	19
<i>Trichuris</i> and Hookworm	4	1.9
<i>Ascaris</i> and Hookworm	11	5.2
<i>Ascaris</i> , <i>Trichuris</i> , Hookworm	37	17.6
		51.9

Cumulative STH



Figure 1. Microscopic appearance of *Echinostome* egg in stool sample

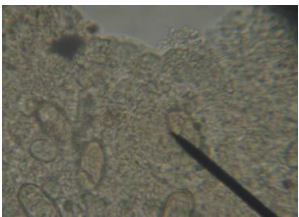


Figure 2. Microscopic appearance of *Heterophyid* eggs in stool sample

The cumulative prevalence for STH was found to be positive for the soil-transmitted helminthes. Single infection with *A. lumbricoides*, *T. trichiura* and hookworm infection was found, respectively. The combined *A. lumbricoides* and *T. trichiura* infection was relatively high. Multiple infections with *Ascaris*, *Trichuris*, and hookworm were found in 37 of the respondents.

Highest infection rate for echinostome eggs was found in age group 15-49, followed by age group 5-14 and age group 1-4. Infection was more common in males than females.

Table 2

Age and Sex Distribution of Study Participants Positive for Echinostoma Eggs, Brgy. Sibonga, Nabunturan, Compostela Valley Province, 5-7 November, 2005 (n=210)

Age grp. (in yrs)	Male			Female			Total		
	No. of Stool	No. of (+)	%	No. of Stool	No. of (+)	%	No. of Stool	No. of (+)	%
<1	8	0	0.0	6	0	0.0	14	0	0.0
1-4	35	2	5.7	30	1	3.3	65	3	4.6
5-14	32	3	9.4	28	0	0.0	60	3	5
15-19	23	3	13	22	0	0.0	45	3	6.7
50-64	10	0	0.0	11	1	9	21	1	4.8
>65	2	0	0.0	3	0	0.0	5	0	0.0
Total	110	0	7.2	100	2	2	210	10	4.0

On the other hand, the highest infection rate of STHs was found in age-group 1-4 years old, while lowest infection rate were found in age-group 50-64 years old. Meanwhile, 45 cases were seen in age-group 5-14 years old. Subjects below 1 year old have higher infectivity rate over age-group 15-19 years. In spite of the uneven representation of the two sexes in the study, prevalence of infections was calculated for males and females separately. In general, males tended to have higher infection prevalence than females.

Table 3

Age and Sex Distribution of Study Participants Infected with Soil-Transmitted Helminths, Brgy. New Sibonga, Nabunturan, Compostela Valley Province, 5-7 November, 2005 (n=210)

Age grp. (in yrs)	Male			Female			Total		
	No. of Stool	No. of (+)	%	No. of Stool	No. of (+)	%	No. of Stool	No. of (+)	%
<1	8	2	25	6	2	33	14	4	28.6
1-4	35	30	86	30	22	73	65	52	80
5-14	32	25	78	28	20	71	60	45	75
15-19	23	6	26	22	0	0.0	45	6	13.3
50-64	10	2	20	11	0	0.0	21	2	9.5
>65	2	0	0.0	3	0	0.0	5	0	0.0
Total	110	65	59	100	44	2	210	109	51.9

Positive cases of *echinostomiasis* across family income can be observed that those who are found positive fall within the annual income bracket Php 30,000.00 – 39, 999.00

or roughly a monthly income of Php 2 500.00. Meanwhile, no infection rate was recorded in respondents belonging to the income bracket Php 50, 000.00 and above.

Table 4

Distribution of Positive Cases of Echinostomiasis across Annual Family Income Brgy. New Sibonga, Nabunturan, Compostela Valley Province, 5-7 November 2005 (n=210)

Annual Income Bracket	No. of Respondents	No. of Respondents (+) Echinostoma Egg (%)
<20,000	23	1 (4.3)
20,000-29,999	52	1 (1.9)
30,000-39,999	93	7 (7.5)
40,000-49,999	15	1 (6.7)
50,000-59,999	13	0
60,000-79,999	12	0
80,000-99,999	2	0
100,000-249,000	0	0
250,000-above	0	0
Total	210	10 (4.8)

Patients found to have *echinostoma* and *heterophyid* infections were interviewed. It was revealed that patients have had episodes of gastric pain, dizziness, diarrhea, and flatulence. On the other hand, *heterophyid* infected individuals shared complaints of peptic ulcer-like symptoms, abdominal discomfort, and intestinal gurgling.

After consultation with a volunteer physician, praziquantel (25 mg/kg body weight) was given to the infected individuals. However, only 1 patient submitted a stool sample for adult fluke collection. The entire bowel movement for the whole day was collected and pooled. Because of the technical difficulties in collecting the minute organism, the team was not successful in collecting *Echinostoma* adult fluke for species determination.

Personal interviews on every household head were conducted together with the respective BHW of each *purok* to describe the food preferences, method of food preparation and handling, and cooking practices of the respondents. Raising freshwater fishes is one of the sources of livelihood of the respondents in the *barangay*. As such, it is the most preferred food. Among the variety of fishes raised in the area are *tilapia* and *hito*. Personal interview revealed that these freshwater fishes are often served as *kinilaw* (a local preparation of raw fish seasoned with vinegar and salt) and *sinugba* (grilling the fish over charcoal). Because these types of preparation are eaten raw or half-cooked, the people may acquire intestinal parasitoses from eating infected fishes. This practice explains the occurrence of *heterophyidiasis*, a foodborne trematode infection acquired from eating raw infected fresh water fishes.

The respondents claimed that with the absence of fishes, snails are the most enticing source of food because of its abundance and accessibility in the community.

Among the variety of snails eaten are golden *kuhol*, *bagungon*, and *suso* usually served with *gata* or coconut milk.

Based on the FGD, respondents claimed that the practice of washing hands before and after handling raw food with soap and water are “sometimes done.” This means that in 10 occasions, the practices are done 3 to 6 times only. The practice of rinsing knives and cutting boards after use are “rarely done” which means that the practice is done once or twice in 10 instances, claiming that washing of knives and cutting boards is done before using.

Furthermore, it is revealed that local residents prefer half-cooked dishes to maintain its nutritional value, preserve its taste and flavor, and conserve cooking fuel. When asked about the reasons for such practices, it was mentioned that such knowledge was learned since childhood. In addition, since majority work in the rice fields and fish ponds, their food is quickly prepared to save time. The practices of thorough cooking through boiling, frying, or grilling are “sometimes done” or done only 3 to 6 times in 10 occasions.

The present food preparation, handling, and cooking practices of the respondents seem to conform to the practices of those areas identified to be endemic for food-borne trematode infections.

Records of the malacologist from the Regional Health Unit show that the study site has abundant *Oncomelania hupensis quadrasi*, the intermediate host of *Schistosoma japonicum*. A similar study collected some snail samples usually eaten by local residents and were sent to the Agriculture Department of UP Diliman for identification. It was confirmed that snails collected were *Pila species*, *Melanoides juncea*, and *Pomacea caniculata*. It was confirmed further that snails submitted contain larval stages of parasites. **However, such requires further validation in the future.**

Conclusions and Recommendations

On the basis of the findings of the study, it is concluded that all age-groups were represented in the study population, with the majority of the participants coming from age groups 49 and below. Male and female genders were approximately equal, and within the annual income bracket of Php 30,000-39,000. The *barangay* is a new focus for *echinostomiasis* in the Philippines, which occurs in all age groups, with the highest egg-positivity rate seen in age-group 15-19. Fishes and snails constitute the major food diet, usually obtained from nearby ricefields and fish ponds. These food items are either served half-cooked or eaten raw as *kinilaw* and *sinugba*. These practices often show a familial trend as it is passed on to the next generation.

It is recommended that with the new cases of *echinostomiasis* in the *barangay*, a wider parasitological/ stool survey be conducted to more accurately describe the burden of this *trematode* infection. Identification of possible snail intermediate hosts and other potentially contaminated aquatic products should be done as this would be a valuable basis for health intervention program and strategies.

Due to technical difficulties, this study failed to recover the adult fluke from the infected individuals for the specific identification of *Echinostoma* species present in the study area. Hence, it is recommended that active-case finding of individuals with

symptoms of *echinostomiasis* be done so that *Echinostoma* species prevailing in the study area may be identified.

An extensive survey of the knowledge, attitude, and practices prevailing in the community will also be helpful in developing a strategy to control this disease. Intensive education campaign is indicated to relay information of the various risks and how these may be reduced, the importance of proper food preparation and food handling, and advocacy on the proper cooking of food. And finally, good laboratory diagnosis of *echinostomiasis* and the development on the capability of the local RHU to diagnose and treat this parasitic infection may be considered essentials for continued surveillance and eventual control of this intestinal *parasitosis*.

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