Intestinal Parasites of Man in Agusan Del Norte, Philippines with Emphasis on Schistosomiasis and Capillariasis

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SUMMARY

A total of 1,920 fecal specimens from residents of seven villages in Agusan del Norte Province, Mindanao, Philippines were examined for schistosomes and common intestinal parasites. *Schistosoma japonicum* eggs were found in 14% of the samples. Infections were more common in males (17%) than females (11%). Age-wise, infections were found in all age groups; infection rates ranged from 7-22% with the highest infection rate in the 10 to 19-year age group. *Capillaria philippinensis* infections were diagnosed in two of five clinically symptomatic patients examined from the Santiago and Cabadbaran area. Subsequently, three additional cases were discovered: two in the Santiago area and one in the Jabonga area. No additional cases were found in the random survey of 1,920 residents of seven villages in Agusan del Norte Province. Soil transmitted helminths were the most common intestinal parasites found: *Trichuris trichiura* (48%), *Ascaris lumbricoides* (45%) and hookworm (41%). Hookworms were predominantly *Necator americanus* (83%), *Entamoeba coli* (16%), *Entamoeba nana* (5%), *Entamoeba histolytica* (3%), and *Giardia lamblia* (3%) were diagnosed less frequently. In addition, the following parasites were found to parasitize 2% or less of the Agusan del Norte population sampled: *Strongyloides stercoralis, Enterobius vermicularis, Cheilomastix mesnili, Entamoeba hartmanni, Trichomonas hominis, Taenia sp*., echinostome, didymozoid, heterophyid, opisthorcid and trematodes and *Paragonimus westermani*. *[Phil J Microbiol Infect Dis 1987; 16(1):5-9]*

Key Words: schistosomiasis, capillariasis *S. japonicum, C. philippinensis*

INTRODUCTION

Schistosomiasis was first reported along the shores of Lake Mainit from what is now Agusan del Norte Province of Mindanao, Philippines by Pesigan in 1947.[1] At that time 6% of the inhabitants of the village of Jabonga were found infected. Shortly thereafter, Pesigan and his staff (1951) reported a 9% infection rate in Jabonga and 15% infection rate in the Ampayan area near Butuan City, and one year later (1952), they reported a 25% infection rate in Butuan City, 9% in Jabonga, and 11% to 54% in other villages.[2,3] More recently Santos (1976) estimated that 10.5% of the overall population of Agusan del Norte was infected with *Schistosoma japonicum* using data gathered during the 1950s and 1960s.[4] This study was undertaken in December 1978 by the Schistosomiasis Control Council of the Philippines, the Agusan del Norte Provincial Schistosomiasis Control Team, the Provincial and Municipal Health Offices, and the U.S. Naval Medical Research Unit No. 2 (NAMRU-2) in order to reassess the status of oriental schistosomiasis in Butuan City and Cabadbaran areas of Agusan del Norte Province and to assess the general problem of intestinal parasites in that province. Until this report, there appeared to be little recent documentation of parasitic infections in this rural area of the Philippines.

Description of the Area

Agusan del Norte Province (Figure 1) is located on wide, fertile, coastal plateau in the northeastern part of Mindanao. This province is bordered on the north and east by the Province of Surigao del Norte and Surigao del Sur, on the south by the Province of Agusan del Sur, and on the southwest by the Province of Misamis Oriental In all of these provinces, except Misamis Oriental, schistosomiasis transmission has been confirmed.

Fertile, coastal plains and valleys along the Agusan River characterize the terrain of Agusan de! Norte Province. The average elevation is 46 meters above sea level: The climate is classified as tropical wet. Temperatures of the coolest month are above 18°C, and rainfall in the driest month is at least 60 mm. There is a minimum of seasonal variation in temperature and precipitation, as both remain high throughout the year. The province is large, 2,590 square kilometers, and is composed of predominantly rural populations totaling 365,000 in 1980. There was a large scale, influx of homesteaders into this frontier region in the 1960s to capitalize on the excellent agricultural potential of the Agusan River Valley and coastal plains. Villages surveyed .in this report were all situated in the Municipalities of Jabonga, Cabadbaran and Butuan City.

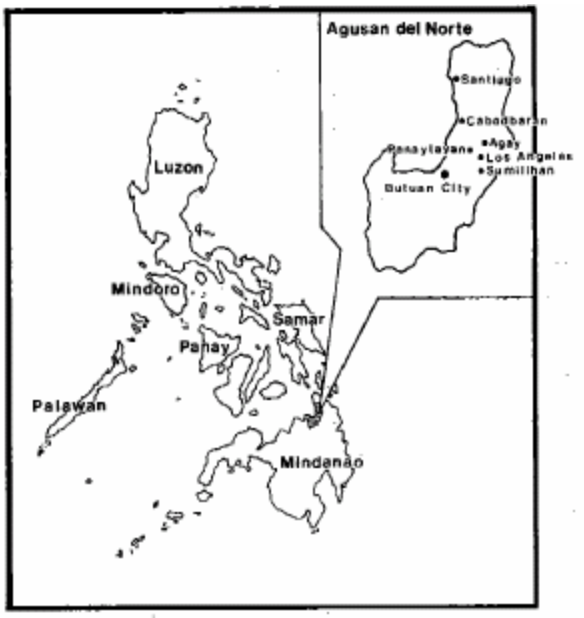

Figure 1. Map of the Philippine Islands with an enlargement of Agusan del Notre Province and the locations of villages surveyed

MATERIALS AND METHODS

Six villages in the vicinity of Butuan City and Cabadbaran were selected for surveillance by the Schistosomiasis Control Team stationed in Cabadbaran. In addition, one village, Santiago, in the Jabonga region was selected as the possible site of *Capillaria philippinensis* transmission. Each village was visited and the residents were assembled and informed as to the purpose of the survey. Volunteers consisting of men; women and children of all ages were registered and given stool cartons. Each was instructed to return the next day with a stool specimen. A sample of 1 or 2 grams of each specimen was mixed thoroughly with 10 ml of 10% formalin in 15 ml screw-capped vials. Stool specimens were subsequently examined microscopically in direct smears and after formalin-ether concentration. Hookworm larvae from Harada-Mori stool cultures of approximately 200 randomly selected specimens were recovered for specific identification.[5]

Selected stool samples were cultured for intestinal protozoa using methods described by Gleason et al and Cross et al.[6,7] In addition, stool specimens of patients with a clinical history consistent with capillariasis were examined for *C. philippinensis* eggs using the procedures described above.

The population sampled was compared with the expected age and sex distribution of the standard rural Philippine population. Prevalence rates were adjusted using this standard distribution. Age of the sample population was not random ($p > .001$). A comparison of the standard and the sampled age distributions of the population is presented in Figure 2. The 10-19 and 30-50+ age groups were over represented while the remaining age groups were underrepresented. There was no significant difference in the sampled populations in regards to sex ($9 > 0.9$).

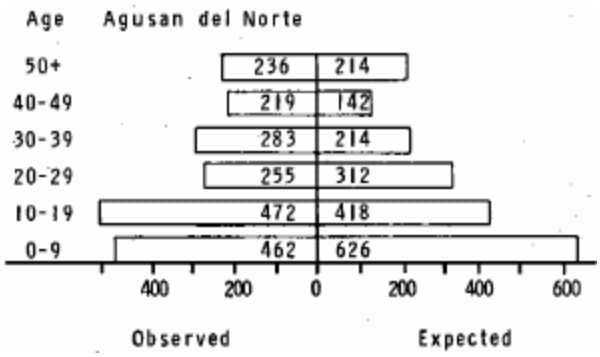

Figure 2. Comparison of sampled Agusan Del Notre Province with expected age distribution based on standard rural Philippine population statistics

RESULTS

Schistosoma japonicum eggs were found in approximately 14% of the residents of seven villages in Agusan del Norte Province (Table 1). Infection rates varied from a high of 32% in Panaytayan to a low of less than 1% in Santiago. The age and sex distribution of schistosome infection is presented in Table 2. More males (17%) than females (11%) were infected. Age specific infection rates did not show the characteristic curve - a low rate on children less than 10 years of age and a plateau of infection rates in older age groups. Instead, infection rates were surprisingly uniform (12-13%) except in the 10 to 19-year group (22%) and in the more than 50-year group (7%).

Intestinal parasites were diagnosed in 85% of the specimens examined: 55% of the specimens examined had 2 or more intestinal parasites. Soil transmitted helminths were the most commonly identified parasites. *Trichuris trichiura* and *Ascaris lumbricoides* were found in 48% and 45%, respectively, of the sampled populations. Hookworm eggs were detected in 41% of the specimens examined. Harada-Mori cultures suggested that *Necator americanus* larvae were responsible for 83% of hookworm infections; *Ancylostoma doudenale* larvae were recovered from the remaining 17% of the cultures. Age-sex adjusted infection rates of intestinal parasites in villages of Agusan del Norte are presented in Table 1. In addition, *Enterobius vermicularis, Strongyloides stercoralis, Hymenolopis nana, Paragonimus westermani,* taeniid tapeworm eggs as well as echinostome, heterophyid, didymozoid, and opisthorcid trematode eggs were detected in 2% of the stool specimens examined. *Entamoeba coli* cysts were found in 16% of the stool specimens; *E. histolytica* cysts in 3%, and *Endolimax nana* and *Giardia lamblia* in 5% and 3%, respectively, of the specimens examined. In addition, *Iodamoeba butschlii, Cheilomastix mesnili* and *Trichomonas hominis* were detected in less than 2% of the stool specimens examined. Age-sex adjusted infection rates for each villages are tabulated in Table 1.

Age and sex distributions of commonly detected protozoan and helminth intestinal parasites are presented in Table 2. *E. coli, T. trichiura*, and *A. lumbricoides* were more frequently diagnosed in females while hookworms were more common in males. Other parasite infection rates did not vary notably in regards to sex. Age-wise *E. coli* was more frequently detected in children less than 10 years of age. Other parasite infection rates did not demonstrate changing patterns with age.

Table 1. Identified parasites of man in Agusan Del Norte Province, Philippines

Parasites*	Payantayan (148)	Agay (406)	Taybonabong (145)	Sumilihan (310)	Los Angeles (310)	Baobsoan (168)	Santiago (433)	Total (1920)
Protozoa								
Entamoeba histolytica	4.8**	1.3	4.9	28	3.2	2.7	4.2	2.9
Entamoeba coli	17.2	7.9	26.2	13.4	13.6	24.5	23.9	15.9
Endolimax nana	6.4	3.2	5.0	6.9	4.6	10.9	8.2	5.3
Giardia lamblia	4.0	3.7	5.3	2.0	1.8	3.0	1.5	2.9
Helminths								
Trichuris trichiura	66.9	43.6	40.1	38.9	43.1	51.6	58.5	47.7
Ascaris lumbricoides	60.6	32.3	33.7	51.3	38.5	42.3	59.9	44.9
Hookworm	63.9	38.6	60.1	49.1	41.3	31.2	33.2	41.1
Schistosoma japonicum	32.4	18.2	6.0	8.1	21.1	21.1	0.8	14.1

**Entamoeba hartmanni, Iodamoeba butschlii, Cheilomastix mesnili, Entamoeba vermicularis, Trichomonas hominis, Stongiloides sterecoralis, Taenia sp., Hymenolepsis nana, Echinostoma sp., Paragonimus westermanii*, Heterophyid, opistorchid and didymozoid-like eggs were diagnosed in less than 1% of sampled population
Number examined in parenthesis
**Percentage infected, Age-sex adjusted

Table 2. Age-sex distribution of intestinal parasites in Agusan Del Norte Province, Philippines

	Sex		Age in years					
Parasites*	Male	Female	0-9	10-19	20-29	30-39	40-49	50+
Protozoa								
Entamoeba histolytica	2*	4	2	3	3	4	4	3
Entamoeba coli	12	21	9	19	20	16	24	18
Endolimax nana	5	7	3	7	5	5	9	8
Giardia lamblia	3	2	3	3	6	2	1	1
Helminths								
Trichuris trichiura	45	51	43	53	51	45	49	48
Ascaris lumbricoides	41	47	52	51	41	43	30	33
Hookworm	48	37	27	48	47	45	50	51
Schistosoma japonicum	17	11	12	22	13	13	12	7

*Percentages expressed to the nearest whole number
Number examined in parenthesis

Five clinically ill patients with symptoms consistent with capillariasis philippinensis submitted fresh stool specimens for examinations while the survey team was in Agusan del Norte in December 1978. Four patients were from Santiago and one patient was a resident of Cabadbaran. Capillarid eggs, consistent with the morphological characteristics of *C. philippinensis*, were found in two specimens submitted by patients from Santiago. However, none of the 1,920 stool specimens from the population sampled in the vicinity of Butuan City, Cabadbaran and Santiago were positive for *C. philippinensis* eggs. Subsequently, two of us (Dr. Pagaran and Dr. Mercado) confirmed parasitologically three additional cases of intestinal capillariasis: two patients from Santiago and one patient from Jabonga. Twenty eggs from one Santiago patient were measured. The length ranged from 39.6-48.4 with a mean of 43.4 and a standard deviation of 2.5. The width was from 17.6-22.0 with a mean of 19.7 and a standard deviation of 1.1.

DISCUSSION

The overall infection rate of *S. japonicum* in Agusan del Norte Province (14%), as determined in this survey, suggests that oriental schistosomiasis is and will be an expanding health problem for this rural area of the Philippines as this province develops to its full agricultural potential along the Agusan River and across the fertile, coastal plains. The difference in overall infection rates in the three municipalities surveyed was striking, yet explicable. The infection rate in the Santiago area of Jabonga was less than 1% whereas in Cabadbaran and Butuan City the infection rates were higher, 18% and 17%, respectively. The municipalities of Cabadbaran and Butuan City were originally selected because they were known or suspected endemic areas in which the government was considering a major irrigation development project. The health impact of schistosomiasis, following an expansion of the irrigated land in these municipalities, was an important factor for the Schistosomiasis Control Council to consider in its mandated role judging and balancing the economic and health benefits and risks of the proposed irrigation system expansion over this coastal plain. The whole proposed irrigation area was endemic for schistosomiasis. No matter how the irrigation system was constructed, there would be a positive impact on the transmission of this disease. With increased irrigation available, more families will move into this rich and fertile valley and eventually contract and contribute to the transmission and maintenance of this snail-borne disease. In contrast, the village of Santiago in Jabonga was specifically selected following the discovery of a possible outbreak of intestinal capillariasis in the vicinity of Santiago.

Soil transmitted helminths are usually the most common intestinal parasites of man in the Philippines.[8] The infection rates of soil transmitted helminths in Agusan del Norte simply document the endemicity of these common intestinal nematodes and the general level of hygiene and sanitation for this rural area of northeast Mindanao. Similar infection rates have been reported throughout the Philippines using the same diagnostic tests.[8] The intestinal protozoan fauna of residents of Agusan del Notre and the infection rates in the village surveyed are also consistent with results from elsewhere in Mindanao,[8] and the rural Philippines where similar diagnostic tests have been used. 9 A number of potential endoparasitic zoonoses were detected in residents of Agusan del Norte. As discussed elsewhere,[9,10] these may simply be spurious cases as only one stool specimen from each individual patient was examined. However, the dietary and sanitary habits of individuals in these remote rural areas of the Philippines easily could account for the sporadic occurrence of the zoonotic helminth infections that were detected in less than 2% of the population examined.

By far the most startling, parasitological discovery made during this study was the documentation of an outbreak of capillariasis philippinensis in the Santiago area on the shore of Lake Mainit and the possibility of capillarid transmission in Mindanao. Dr. Pagaran, the Municipal Health Officer of Cabadbaran, had admitted 12 patients to the municipal hospital with

an admission diagnosis of amoebiasis unresponsive to antiamoebic therapy. During hospitalization antiamoebic therapy was continued to no avail. The clinical courses of these patients were similar and consistent with that described for intestinal capillariasis.[11] The initial diarrhea would stop and be followed by dehydration with difficulty in swallowing. Death usually occurred within two weeks of hospitalization. *Capillaria philippinensis* eggs were detected in the stool specimens of 2 of 5 patients examined from Santiago and Cabadbaran in December 1978. Both patients were treated with mebendazole (Antiox) at 400 mg/day x 20 days and upon completion of the prescribed treatment both patients recovered.

Nearly 2,000 confirmed cases of intestinal capillariasis have been documented in the Philippines. Most of these have occurred in northern Luzon where endemic areas have been reported in Cagayan, Ilocos Norte, Ilocos Sur, La Union, Pangasinan, and Zambales provinces. Elsewhere there have been confirmed cases of intestinal capillariasis found in southern Leyte, possibly from Misamis Oriental or Bohol, and, with this report, in Agusan del Norte. More than 300 confirmed cases were diagnosed in the St. Bernard area of southern Leyte. [8] However, only one case was reported from either Bohol or Misamis Oriental[12] and to date only five cases have been reported in the Santiago and Jabonga areas of Agusan del Norte. A1though it is clear that this disease is being transmitted in the southern Leyte region of the Visayan Islands, the cases reported from both Bohol/Misamis Oriental and Agusan del Norte may have originated from a confirmed endemic area in the Visayan islands such as southern Leyte.

Experimental studies, summarized by Cross and Bhaibulaya,[13] have demonstrated that various fresh water and brackish water fish from lagoons, lakes and rivers of the Philippines support the development of *C. philippinensis* eggs to infective stage larvae. Transmission to humans occurs when uncooked infected fish are eaten. Follow up epidemiological studies in the Santiago area revealed that the residents have some of the same eating habits as llocanos. They enjoy eating some species of uncooked fish from Lake Mainit and the rivers flowing from the Lake. Infections with heterophyid trematodes attest to this dietary habit among residents. As can be seen in an analysis of the intestinal parasite fauna of residents of Agusan del Norte, like their Ilocano counterparts, they also enjoy eating fresh water snails and crabs found in the province consequently acquiring echinostomiasis and paragonimiasis.

There is speculation that fish-eating birds may be natural reservoirs of intestinal capillariasis and that the disease, has been spread through the Philippines and elsewhere in Southern Asia over the migratory paths of suitable avian hosts that feed on fresh and brackish water fish.

This parasite of man in the Philippines probably exists elsewhere in the Philippines, Southeast Asia and the Far East but remains unrecognized close to 20 years after its discovery in northern Luzon. Unfortunately, even after 20 years physicians and medical technicians still fail to recognize the distinct symptoms and/or misidentify the characteristic eggs of the parasite in stool specimens. Gastroenteritis with unknown etiology could easily be intestinal capillariasis in Southeast Asia and the Far East where physicians are not familiar with the clinical presentation and laboratory technicians cannot distinguish *C. philippinensis* eggs from one of the most common intestinal helminths in Asia, *T. trichiura* (Figure 3). A presumptive diagnosis can usually be made when a patient from an endemic or suspected area of transmission reports a gurgling stomach, abdominal pain and diarrhea. However, confirmed diagnosis requires finding eggs, and less infrequently larvae or adult specimens of *C. philippinensis* in stool specimens.

Figure 3. Comparison of *Capillaria philippinensis* and *Trichuris trichiura* eggs as seen in stool specimens.

Acknowledgements

The authors thank the Schistosomiasis Control Team, Cabadbaran and the staff of the Municipal and Provincial Health Offices in Cabadbaran and Butuan City, Agusan del Norte for their assistance in making the survey a success. They also thank the staff of the Data Processing Department and the Parasitology Department of NAMRU-2 for technical assistance.

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