

# INTESTINAL PARASITES AND MALARIA IN THE BADA AND GIMPU AREAS OF CENTRAL SULAWESI, INDONESIA

W.P. CARNEY\*, J. PUTRALI\*\*, S. MASRI\* and SALLUDIN\*\*

\*U.S. Naval Medical Research Unit No. 2 (NAMRU-2), Jakarta Detachment, APO San Francisco 96356; \*\*Provincial Health Office, Palu, Central Sulawesi, Indonesia.

## INTRODUCTION

Following the recent discovery of schistosomiasis in North Lore District of the Napu Valley drainage system (Carney *et al.*, 1974a), a study was undertaken to determine if *Schistosoma japonicum* was being transmitted at lower elevations along the Lariang River which drains the Napu Valley into the Strait of Makassar. This was one of a series of surveys recently undertaken to document the geographic distribution and prevalence of *S. japonicum*, as well as other human parasites, throughout Central Sulawesi (Hadidjaja *et al.*, 1972; Clarke *et al.*, 1974; Carney *et al.*, 1974a and 1974b; Cross *et al.*, unpublished data). Prevalences of intestinal parasites and malaria in four villages in the Bada Valley and one village in the Gimpu Valley of Central Sulawesi, which were surveyed in January 1973, are reported herein.

## DESCRIPTION OF AREA

Bada and Gimpu Valleys are situated in the Takolekadju mountain range of Central Sulawesi (Fig. 1). Both valleys are in the Lariang drainage system which eventually flows into the Strait of Makassar on the west coast of Sulawesi. Bada Valley lies between 1° 45' and 2° 00' South latitude and 120° 08'

This study was supported by funds provided by the Indonesian Ministry of Health and by the Bureau of Medicine and Surgery, Navy Department for Work Unit MF51.524.009-0030B F61.

The opinions and assertions contained herein are those of the authors and are not to be construed as official or as reflecting the views of the Indonesian Ministry of Health or the U.S. Navy Department.

Reprint requests to Publications Office, NAMRU-2, Box 14, APO San Francisco 96263.

and 120° 20' East longitude along the main course of the Lariang River with elevations varying between 700 and 800 meters. Gimpu Valley lies between 1° 35' and 1° 40' South latitude and 120° 00' and 120° 05' East longitude at an elevation of 420 meters along the course of the Koro River, a tributary of the Lariang River. Both valleys are isolated; Gimpu, however, can be reached by jeep from Kulawi during certain times of the year. Bada is most easily reached by a two-day forest trail from Gimpu. Politically, Bada is in South Lore District, Poso Regency, while Gimpu is in Kulawi District, Donggala Regency of Central Sulawesi Province.

At least one-third of the Bada Valley consists of dry, presently uncultivated, grass-covered plains. About 600 hectares are under wet rice cultivation and the rest of the terrain consists of swamps, lowland forest or abandoned rice fields. Swampy areas and uncultivated rice fields are used for grazing domestic animals. In the Gimpu Valley there are 600 hectares of wet rice fields. The rest of the valley floor is covered by lowland forest, swamps or abandoned rice fields.

Rice, the principal economic product from both valleys, is grown in sufficient quantities to be exported to other communities in Central Sulawesi. Cattle, horses, water buffaloes, pigs, dogs and chickens are common in both areas.

Bada residents (2750) are mostly indigenous Western Torajans (Kaili) who speak a local dialect of the Lore (Kaili-Pamona) family of languages. More than 90% are Christians, members of the Central Sulawesi

## INTESTINAL PARASITES OF CENTRAL SULAWESI

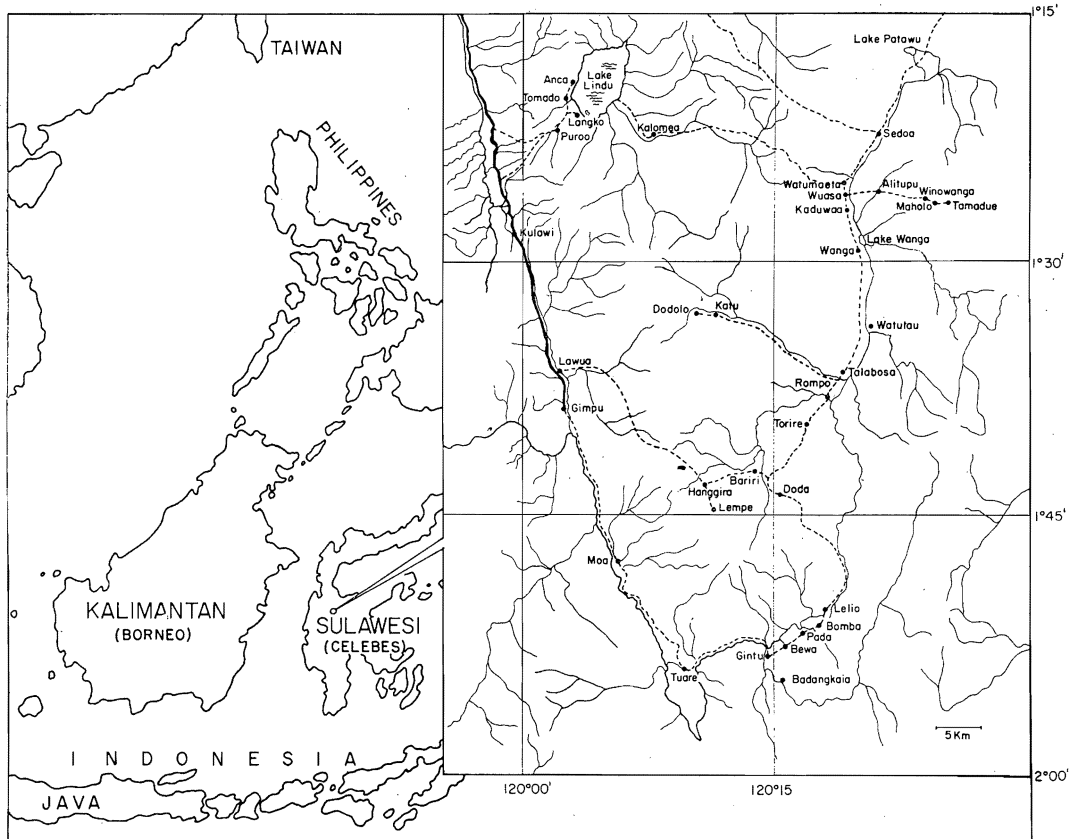


Fig. 1—Map of Central Sulawesi identifying the villages surveyed and their locations in reference to the Lindu and Napu Valleys.

Christian Church, while the remaining 10% are Buginese Moslems who have migrated from South Sulawesi.

In contrast, most Gimpu inhabitants (2200) have migrated from other regions; about half are Buginese Moslems from South Sulawesi and half Kaili, mostly Christians, belonging to the Salvation Army.

Five villages were selected for this study, four from the Bada Valley: Gintu - 881, Pada/Bomba - 585, Bewa - 415, Badangkaia - 808; and, from the Gimpu Valley, the village of Gimpu - 254. Numbers refer to population estimates according to the 1971 general census.

## MATERIALS AND METHODS

Blood specimens were obtained from finger tips between the hours of 2000 and 2200. Thick and thin smears were made onto microscope slides and air dried for 24 hours. Thin smears were fixed in methanol in the field, and both thin and thick preparations were stained in 3-4% Giemsa (pH 6.8 - 7.0) for 1 hour after being brought to Jakarta. At the time of blood collections subjects were given stool cartons and instructed to return the next day with a faecal specimen. One or two grams of faeces were obtained, placed in screw-capped bottles containing 15 ml of 10% formalin, and mixed thoroughly. Specimens

were subsequently examined by direct and formalin-ether concentration methods. Microscopic examinations of the blood smears and stools were made at the NAMRU-2 laboratory in Jakarta.

## RESULTS

A total of 524 stool specimens from four villages in the Bada and Gimpu areas of Central Sulawesi were examined. One or more intestinal parasites were found in 77% of those examined, while 36% of the population had two or more intestinal parasites. Table 1 lists prevalences of intestinal parasites from villages surveyed. *Schistosoma japonicum* was conspicuously absent from specimens examined. The most common helminths were hookworm (53%) and *Ascaris lumbricoides* (17%). *Trichuris trichiura* was found in only 9% of the stools examined. In

Gintu, however, *T. trichiura* was common (28%), whereas in the other villages infections varied between 2 and 4%. *Ascaris lumbricoides* was relatively common; more than 20% in three villages, Gintu, Pada/Bomba and Gimpu, but rare, less than 5%, in Bewa and Badangkaia. Hookworm rates were high in the Bada Valley (48 to 61%), but much lower in Gimpu (27%). Other helminths noted infrequently (1% or less) were *Enterobius vermicularis*, a heterophyid, an echinostome and a fasciolid. *Entamoeba coli* (23%) was the most common intestinal protozoan. Prevalences of other intestinal protozoans were: *Endolimax nana* (10%), *Giardia lamblia* (7%), and *Entamoeba histolytica* (4%); *Entamoeba hartmanni*, *Iodamoeba bütschlii* and *Balantidium coli* were found in 1% or less of stool specimens examined.

Most parasites were equally distributed among the 285 males and 257 females exam-

Table 1

Prevalence of intestinal parasites from five villages in the Bada and Gimpu Valleys, Central Sulawesi.

Parasite species	Gintu	Pada/ Bomba	Bewa	Badangkaia	Gimpu	Total
<i>Entamoeba histolytica</i>	4*	3	3	13	0	4
<i>Entamoeba hartmanni</i>	1	1	0	4	0	1
<i>Entamoeba coli</i>	18	22	30	27	20	23
<i>Endolimax nana</i>	7	9	15	9	9	10
<i>Iodamoeba bütschlii</i>	1	1	1	0	0	1
<i>Giardia lamblia</i>	9	7	4	5	7	7
<i>Balantidium coli</i>	0	1	0	0	0	0(0.2)
<i>Ascaris lumbricoides</i>	28	20	5	4	20	17
<i>Trichuris trichiura</i>	29	2	3	2	4	9
Hookworm	61	61	50	48	27	53
<i>Enterobius vermicularis</i>	1	0	0	0	0	0(0.2)
Heterophyid species	1	0	0	0	1	1
Echinostome species	1	0	4	0	0	1
Fasciolid species	0	0	3	0	0	1
Total number examined	140	163	109	56	74	542

\* Percentages expressed to the nearest whole number.

## INTestinal PARASITES OF CENTRAL SULAWESI

ined (Table 2). No infection rates varied more than 4% between sexes.

Prevalences of intestinal parasites are listed by age in Table 2. Both *A. lumbricoides* and *T. trichiura* rates decreased with age, while hookworm infection rates appeared to increase with age. *Giardia lamblia* was most common in younger age groups, as expected. Other parasitic infection rates showed no discernible pattern in relation to age.

*Plasmodium falciparum* was detected in 18 of 748 blood smears examined (2.4%). All were found in three villages in the Bada Valley, namely Gintu, Pada/Bomba and Bewa. Sixteen were from persons less than 20 years of age and infections were about equally distributed between males (8) and females

(10). *Brugia malayi* microfilaria were detected in 9 of the blood smears examined (1.2%). Infections were found in all villages except Badangkaia.

## DISCUSSION

The absence of *S. japonicum* in inhabitants of the Bada and Gimpu Valleys was the most important finding of this study. Oriental schistosomiasis is endemic to the North Lore District of the Napu Valley drainage system (Carney *et al.*, 1974a) and the Lindu Valley of the Palu Valley drainage system (Clarke *et al.*, 1974) of Central Sulawesi. As evidence accumulates it appears that the transmission of *S. japonicum* in Sulawesi is limited to high mountain valleys, with similar geological

Table 2

Prevalence of intestinal parasites by age and sex from five villages in the Bada and Gimpu Valleys, Central Sulawesi.

Parasite species	Sex		Age (in years)					
	Males	Females	0-9	10-19	20-29	30-39	40-49	50-more
<i>Entamoeba histolytica</i>	4*	4	4*	5	3	6	1	0
<i>Entamoeba hartmanni</i>	1	1	1	2	1	0	0	3
<i>Entamoeba coli</i>	22	24	22	27	25	18	22	17
<i>Endolimax nana</i>	8	12	8	8	15	11	9	9
<i>Iodamoeba bütschlii</i>	1	1	1	0	3	0	1	0
<i>Giardia lamblia</i>	7	7	15	8	4	4	0	0
<i>Balantidium coli</i>	0(0.4)	0	1	0	0	0	0	0
<i>Ascaris lumbricoides</i>	16	19	27	22	10	11	12	11
<i>Trichuris trichiura</i>	9	10	14	12	9	4	6	6
Hookworm	51	55	47	51	51	58	61	60
<i>Enterobius vermicularis</i>	0	0(0.4)	1	0	0	0	0	0
Heterophyid species	0	1	0	2	0	1	0	0
Echinostome species	1	1	2	1	0	2	0	0
Fasciolid species	0(0.4)	1	0	1	1	0	0	3
Total number examined	285	257	126	128	101	83	69	35

\* Percentages expressed to the nearest whole number.

histories, near or above 1000 meters elevation. The absence of *S. japonicum* in Bada (700-800 meters elevation) and Gimpu (420 meters elevation) is consistent with results obtained elsewhere in Sulawesi at similar or lower elevations (Cross *et al.*, 1972 and unpublished data; Joseph *et al.*, unpublished data, Van Peenen *et al.*, 1973 and Carney *et al.*, 1974b).

At the same time the human survey was being conducted, trained technicians made a cursory search for *Oncomelania hupensis*, which has been incriminated as the molluscan host of *S. japonicum* in the Lindu and Napu Valleys (Carney *et al.*, 1973a and 1974a). No oncomelanids were found, which is also consistent with results of malacological surveys elsewhere in Central Sulawesi at similar or lower elevations (unpublished data).

This study constitutes the first published report of intestinal parasites in this part of Sulawesi. Infection rates of soil-transmitted helminths are similar to those obtained in the Lindu Valley (Clarke *et al.*, 1974), where hookworm was by far the most common helminth and *A. lumbricoides* and *T. trichiura* were less frequently encountered. Species of hookworm reported in this survey are not known. However, Clarke *et al.*, (1974) demonstrated that *Necator americanus* was the only species found in the nearby Lindu Valley. Only one case of *E. vermicularis* was found in Bada Valley, probably because of techniques which are not recommended for the detection of this parasite.

Finding of a heterophyid trematode in stool specimens from two villages, Gintu and Gimpu, was unusual. Heterophyids have not been previously reported as parasites of man in Sulawesi, although cases have been reported from Indonesia (Kwo and Lie, 1953). Predominant species in Indonesia are contained in the genus *Haplorchis* (Lie, 1969).

The occurrence of echinostome eggs in 4% of the Bewa residents and in 1% of Gintu

residents was not surprising. Although human echinostomiasis is uncommon in Indonesia today, the Lindu Valley of Central Sulawesi has been of particular interest to parasitologists because prevalence rates of *Echinostoma lindoense* in villages on the shore of Lake Lindu use to range from 24% to 96% (Sandground and Bonne, 1940). The recent disappearance of echinostomiasis from the Lindu Valley has been discussed by Carney *et al.*, (1973b). Several cases of human echinostomiasis were recently reported from the Palu Valley of Central Sulawesi, but the species involved was not determined (Clarke *et al.*, 1974).

The fasciolid species found in 3% of the Bewa residents is uncertain, but probably was *Fasciola hepatica* which is common in cattle of Central Sulawesi (unpublished data).

Species of intestinal protozoans encountered in Bada and Gimpu Valleys were also reported as endemic to other areas of Sulawesi (Cross *et al.*, 1972; Clarke *et al.*, 1974; Carney *et al.*, 1974a and 1974b) with the exception of *B. coli*, which, to our knowledge, has not been previously reported from humans in Sulawesi.

The low malaria prevalence rate (2.4%) is consistent with results of other surveys in Central Sulawesi (Clarke *et al.*, 1974 and Carney *et al.*, 1974a and 1974b), but in contrast to the high rates reported in the Margolembo area of South Sulawesi (Cross *et al.*, 1972). The microfilarial rate (1.2%) is low when compared to results of a recent survey in the nearby Lindu Valley where Clarke *et al.*, (1974) reported a 5.4% infection rate. In the present study, however, calibrated micropipettes were not used. Microfilaria results were obtained from thick smears read for malaria.

## SUMMARY

A survey for blood and intestinal parasites was carried out in the Bada and Gimpu Valleys

of Central Sulawesi, Indonesia. A total of 542 stool specimens were examined from 285 males and 257 females ranging in age from 1 to 90 years. At least one or more intestinal parasites were found in 77% of the population sampled. *Schistosoma japonicum* was not found, even though both valleys are situated down-stream from known endemic areas along the Lariang River drainage system. Hookworm, *Entamoeba coli*, *Ascaris lumbricoides*, *Endolimax nana*, *Trichuris trichiura*, *Giardia lamblia* and *Entamoeba histolytica*, in that order, were the most common intestinal parasites encountered. Other intestinal parasites noted infrequently were *Entamoeba hartmanni*, *Iodamoeba bütschlii*, *Balantidium coli*, *Enterobius vermicularis*, a heterophyid species, an echinostome species, and a fasciolid species. Parasitemias due to *Plasmodium falciparum* were detected in 2.4% of the population sampled. All were from villages in the Bada Valley.

#### ACKNOWLEDGEMENTS

The authors wish to thank the following persons who assisted in this survey. Moh. Yasin, Dhermawan Setiabudi, Moh. Sudomo, Mr. Petrus Bunga and Nurse Mariana of South Lore, Mr. Richard See, Data Processing Dept., NAMRU-2, Taipei and the staff of the Parasitology Dept., NAMRU-2, Jakarta for technical assistance. For their continuing administrative support, thanks to Dr. J. Sulianti Saroso and Dr. Arbain Joesoef, Office of the Director General Communicable Disease Control, Jakarta and Dr. P.F.D. Van Peenen and Dr. R.H. Watten of NAMRU-2.

#### REFERENCES

- CARNEY, W.P., HADIDJAJA, P., DAVIS, G.M., CLARKE, M.D., DJAJASASMITA, M. and NALIM, S., (1973a). *Oncomelania hupensis* from the schistosomiasis focus in Central Sulawesi (Celebes), Indonesia. *J. Parasit.*, 59 : 210.
- CARNEY, W.P., VAN PEENEN, P.F.D., TANU-DJAJA, S., SUDOMO, M., DJAJASASMITA, M., WIRORENO, W., CLARKE, M.D., CROSS, J.H., SULIANTI SAROSO, J. and WATTEN, R.H., (1973b). Echinostomiasis lindoensis: a disease that disappeared. *Ninth Intern. Cong. Trop. Med. Malaria*, Athens, Greece, 14-21 October, 2 : 138.
- CARNEY, W.P., MASRI, S., SALLUDIN and PUTRALI, J., (1974a). The Napu Valley, a new schistosomiasis area in Sulawesi, Indonesia. *Southeast Asian J. Trop. Med. Pub. Hlth.*, 5 : 246.
- CARNEY, W.P., PUTRALI, J. and CALEB, J.M., (1974b). Intestinal parasites and malaria in the Poso Valley, Central Sulawesi. *Southeast Asian J. Trop. Med. Pub. Hlth.*, 5 : 368.
- CLARKE, M.D., CARNEY, W.P., CROSS, J.H., HADIDJAJA, P., OEMIJATI, S. and JOESOEF, A., (1974). Schistosomiasis and other human parasitoses of Lake Lindu in Central Sulawesi (Celebes), Indonesia. *Amer. J. Trop. Med. Hyg.*, 23 : 385.
- CROSS, J.H., CLARKE, M.D., IRVING, G.S., DUNCAN, C.F., PARTONO, F., HUDOJO, SRI OEMIJATI, NOOR, M. and BORAHIMA, (1972). Intestinal parasites and malaria in Margolembo, Luwu Regency, South Sulawesi, Indonesia. *Southeast Asian J. Trop. Med. Pub. Hlth.*, 3 : 587.
- HADIDJAJA, P., CARNEY, W.P., CLARKE, M.D., CROSS, J.H., JOESOEF, A., SULIANTI SAROSO, J. and SRI OEMIJATI, (1972). *Schistosoma japonicum* and intestinal parasites of the inhabitants of Lake Lindu, Sulawesi (Celebes). A preliminary report. *Southeast Asian J. Trop. Med. Pub. Hlth.*, 3 : 594.
- Kwo, E.H. and LIE, K.J., (1953). Beberapa parasit jang terdapat pada binatang dan

- jang ditemukan pada manusia di Indonesia. III. Trematoda. *Maj. Kedok. Indon.*, 3 : 3.
- LIE, K.J., (1969). Schistosomiasis and other snail transmitted helminthiasis. *Proceedings of the 4th Southeast Asian Seminar Parasit. Trop. Med.*, Manila, Ed. C. Harinasuta. p. 207.
- SANDGROUND, J.H. and BONNE, C., (1940). *Echinostoma lindoensis* n sp.: a new parasite of man in the Celebes with an account of its life history and epidemiology. *Amer. J. Trop. Med. Hyg.*, 20 : 511.
- VAN PEENEN, P.F.D., CARNEY, W.P., SULIANTI SAROSO, J., SEREGEG, I.G., SUDOMO, M. and PUTRALI, J., (1973). Mammals and their parasites in Gumbasa Valley, Central Sulawesi, Indonesia. *Ninth Inter. Cong. Trop. Med. Malaria*, Athens, Greece, 14-21 October, 2 : 95.