

## A Study on Intestinal Helminthic Infection of a Rural Community in Bali

By: Soesanto<sup>1</sup>, Moetrarsi<sup>1</sup>, and Berry J. Cerf<sup>2</sup>

1. Department of Parasitology, University of Gadjah Mada Faculty of Medicine, Yogyakarta;
2. University of Columbia Department of Anthropology, New York, N. Y.

---

### ABSTRAK

Soesanto, Moetrarsi & Berry J. Cerf — *Studi tentang infeksi cacing perut pada segolongan masyarakat desa di Bali*

Penyakit infeksi cacing usus terutama yang termasuk infeksi cacing usus yang ditularkan melalui perantara tanah merupakan masalah yang umum di negara yang sedang berkembang, yang masih kurang menyadari arti kebersihan perseorangan dan sanitasi.

Juga cara-cara kehidupan dan tradisi yang turun-temurun yang kurang baik dapat mempermudah berlangsungnya penularan infeksi cacing tersebut.

Program pengobatan penyakit cacing secara periodik dapat diharapkan akan memperbaiki status gizi anak-anak, sambil menunggu membudayanya cara-cara hidup yang lebih baik.

*Key Words:* soil transmitted helminths — Kato thick smear method — *Taenia solium* — periodic deworming — nutritional status

---

### INTRODUCTION

Much effort in recent years have been devoted to emphasizing the realization that rural health problems tend to reflect the complex, multifaceted interaction of many socio-cultural and environmental variables. Specialists in a given academic or medical field have found that the dimension and causal factors of most rural health problems cut across the spectrum of arbitrarily defined department boundaries, and thus represent inter-disciplinary phenomena in the truest sense of the word.

The humidity and the temperature which are suitable for parasitic development, poor sanitation and ignorance are factors leading to the high prevalence in many places. On the other hand, the magnitude of incidence rate illustrates the existing sanitation of that community.

Soil-transmitted helminths are considered to be the common parasites with very close association with elements mentioned above. *Ascaris*, the giant round worm, causes the most prevalent infection of man with one billion cases throughout the world (Peters, 1978). Yet disability appears to be minor and death relatively rare (Hunter, 1976).

## MATERIAL AND METHODS

The research site was the village located at altitude of 600 meters in the southern foothills of Bali's largest and most sacred volcano, Gunung Agung. The village is divided into 13 *banjars* or hamlets. There are four inner *banjars* clustered in the center of the village, with the nine other *banjars* radiating along north-south axes from the central cluster. The arable land of the village is almost evenly divided between irrigated and unirrigated paddy-fields.

The center of the village contains the village office, schools, market, numerous small shops and food stalls, and a health and family planning clinic. There is no piped water in the village, this being carried in buckets from springs. There are also no latrine available. Health services are provided by a midwife and by numerous traditional practitioners, *balian*, who individually practice different specialties. There is a community health center staffed by a physician in the village to the east, but it is rarely patronized by residents of the study village due to the 10 kilometers round-trip distance involved.

The village population of 5000 inhabit 1000 household which are dependent upon different combinations of irrigated and dry land agriculture, animal husbandry, skilled and unskilled labour and petty trading as an economic base.

The participants of this study originated from a random stratified sample of households drawn from three *banjars*. Aging of children was accomplished by translating the Balinese calendar to a Gregorian system of 12 months, 365-day years, there being a direct and predictable relationship between the two calendrical systems.

Fresh stool samples were brought to the examination sites in previously distributed plastic containers. The samples were fixed in the field using the Kato thick smear method and examined a few hours later for qualitative and quantitative analysis. Kato method is considered to be a simple method of fecal examination, especially for the detection of *Ascaris*, *Trichuris* and hookworm ova.

## RESULTS

The incidence of helminthic infection observed from the sample (TABLE 1) is consistent with the findings of Clarke *et al.* (1973) who report that in Indonesian population at large nearly 100% of the rural population is infected with one or more species of soil-transmitted helminths. This high incidence showed can be linked to a variety of environmental and socio-cultural variables. Among these is the observation that the residents of the sample *banjars* exhibit a clustered, high density settlement pattern which is typical of many *banjars* throughout Bali. This particular trait has the effect of encouraging large number of peoples, many of whom are infected, to make use of a limited number of conveniently located irrigation ditches and gardens for excreta disposal.

TABLE 1. — The incidence of helminthic infestation of adult and children among samples in Bali, 1979.

Number of Parasite Species	Children Age ≤ 12 mo. (N = 13)	Children Age > 12 mo. - ≤ 5 yr (N = 44)	Adult Females (N = 74)
None	9 (.69)	0	0
One or more	4 (.31)	44 (1.00)	74 (1.00)
Two or more	1 (.08)	39 (.89)	70 (.95)
Three	0	4 (.09)	10 (.14)

TABLE 2. — The intensity of helminthic infestation of adult and children among samples in Bali, 1979.

Parasite Species	Children Age ≤ 12 mo. (N = 13)			Children Age > 12 mo. ≤ 5 yr (N = 44)			Adult Females (N = 74)		
	None	Mild	Moderate/Heavy	None	Mild	Moderate/Heavy	None	Mild	Moderate/Heavy
<i>Ascaris lumbricoides</i>	9 (.69)	1 (.08)	3 (.23)	3 (.07)	3 (.07)	38 (.86)	4 (.05)	21 (.28)	40 (.66)
<i>Trichuris trichiura</i>	13 (1.00)	—	—	2 (.04)	38 (.86)	4 (.09)	0 (0)	68 (.92)	6 (.08)
Hookworm	13 (1.00)	—	—	39 (.89)	5 (.11)	0 (0)	64 (.86)	9 (.12)	1 (.01)
<i>Taenia</i> sp.	13 (1.00)	—	—	44 (1.00)	—	—	74 (1.00)	—	—

TABLE 2 presents an opportunity to examine the relative threat to health, based upon intensity of infection, which is posed by different helminthic species for the members of the sample. The species expected were the soil-transmitted worm and cestode. It is evident that infection with *Ascaris* presents the greatest threat to children as only three of the subjects in the age 1-5 cohort are free of infection with this parasite. Additionally, the large majority of those who are infected are suffering from moderate or heavy infections, based on quantitative egg counts.

The information presented in TABLE 1 and TABLE 2 indicates that *Ascaris* infection presents the most significant threat to under-five children both in terms of incidence and intensity of infection. Elaborating upon this observation, TABLE 3 shows that among children residing in the outer *banjars*, the prevalence rate of intestinal helminthic infection is lower or almost the same as inner *banjars* in contrast to the better element available in the inner *banjars*.

TABLE 3. — The prevalence of outer and inner *banjars* sample in Bali suffering from helminthic infection, 1979.

Parasite	Outer Banjar	Inner Banjar
<i>Ascaris lumbricoides</i>	.87	1.00
<i>Trichuris trichiura</i>	.82	.82
Hookworm	.08	.18

## DISCUSSION

Soil-transmitted helminths, namely *Ascaris*, *Trichuris* and hookworm, seemed to dominate the prevalences in the study area and are known to cause the most common worm diseases in Indonesia. The infection occurs as single or mixed one. As shown in TABLE 1 starting at the age below one children are harbouring more than one species. As already recognized *Ascaris* infestation was detected in under 12-months baby. Noerhayati *et al.* (1979) reported mixed infection of *Ascaris*, *Trichuris* and hookworm in a 6-month baby. It confirms the possible occurrence of infestation in under 12-months children. TABLE 1 shows that among the study group of up to 12 months 69% of children were not harbouring helminthic infestation, but 100% of children above 12 months were having problem with helminthic infection.

The large difference in magnitude of infection incidence between children above and below 12 months can be traced to the influence of Balinese religion and child rearing practices. For example, before a Balinese infant reaches a certain age, he is specifically prohibited to come into contact with the ground. Eventually even after that point when a Balinese infant make his first contact with the ground, he nonetheless continues to be held and carried almost constantly. Indeed, compared with older preschool children, the sight of less than 12 months in age crawling, and sitting at ground level is an extremely rare event. Another problem is excreta disposal. Through excreta disposal is initially localized in irrigation ditches or gardens, such attempts are quickly defeated through the activities of numerous free ranging pigs and dogs which subsequently randomly distribute fertile parasite eggs throughout the range of human habitation including earthen-floored food preparation areas. The opportunity of coming into contact with contaminated soil within the vicinity of Balinese *banjars* are therefore considerable.

The intensity of helminthic infection represents a threat to people's health. The 12-months children or younger who are infected, are only harbouring single infection, namely and exclusively *Ascaris* (TABLE 2). Nothing else are detected in this cohort. By way of contrast, in the 1-5 cohort infection with *Trichuris trichiura* was widely detected, although in most cases mild. It should be stressed that since most children in this cohort are harbouring mixed infection, the mild *Trichuris* infection is in addition to a moderate or heavy *Ascaris* infection in most cases. The potential for additive consequences in such a situation should not be overlooked. The pattern among adult females is again similar to the profile exhibited by 1-5 year children, that is a predominance of moderate or heavy *Ascaris* infection usually coupled with mild trichuriasis.

Among both adult females and young children, hookworm infection is rare. This fact is probably attributable to the location of study site in close proximity to a recently active volcano and the resultant high clay content of soil in the region. This environmental feature is unsuitable for the hookworm life cycle which requires sandy soils in order to flourish.

The complete absence of *Taenia solium* infection was a surprise. The Balinese are avid consumers of pork, particularly on ceremonial occasions when *lawar* (a mixture of chopped pork meat, innards and blood) is a staple. The pork

was not always thoroughly cooked resulting in a definite risk of *taeniasis* to human population.

In geographical terms, references made in this paper to inner *banjar* versus outer *banjar* relate only a radius of only one kilometer. In simple terms, there is a very real division at hand in the village in term of the degree to which modernizing trends and access to services are influencing the daily lives of *banjar* residents. Among the factors which are changing traditional forms of behaviour in the inner *banjar* are the following: concentration of resident civil servants, including teachers and health center personnel; a greater number of people able to read and understand the national language; the availability of junior high school, and health and family planning clinic; an asphalt intervillage road over which travels a daily stream of travelers, goods and news. None of these elements are possessed by the other *banjar* residents. In contrast to most outer *banjar* residents those studied in the inner *banjar* seem to be aware of the importance of preventive health measures. The regular use of soap for bodies, clothes and dishes is a modest but effective step taken by the inner *banjar* residents, and it distinguishes from the outer *banjar* inhabitants. The inner *banjar* residents appear to make more frequent use of western-modelled government medical service. According to elements mentioned above the inner *banjar* residents seem to be better off in terms of the access to intestinal helminthiasis. TABLE 3 shows the differences of helminthiasis frequency between inner and outer *banjars* were insignificant ( $p > 0.05$ ). The reason of this feature is probably because of the continuous influence between the two types of *banjar* which is all pervasive. It indeed requires a deep further study.

Besides the epidemiological study mentioned the control of existing infection is worthwhile. What should be done to help alleviate a nearly unbroken cycle of exposure? Among various means the *periodical-deworming* is a simple one. Proper sanitation and other means such as the provision of clean water make a substantial difference in the amount of disease in an area, but the financial problem involved is enormous. The success also depends on rigorous maintenance and alteration of cultural habits. With sanitation and clean water supplies in developing areas, deaths from *Ascaris* and other intestinal helminths can be expected to decrease 0–50% (Arfaa, 1974; Khalil, 1926, Preston, 1972; White, 1972). Treatment is important to be given in a community but it requires periodic chemotherapy for an indefinite period (Hunter, 1976; Warren, 1978). The deworming can be conducted periodically at under-five weighing programme which covers nutrition supplementation. It does match with the statement indicating that infection may be a prominent cause of poor nutrition (Mata, 1978; Condon Paoloni, 1977; Rowland, 1977).

## CONCLUSION

The high soil-transmitted helminth infestation can be linked to a variety of environmental and socio-cultural variables. In the study area the high density settlement and some particular traits considered as the greatest elements aggravating the prevalence.

*Ascaris*, the giant intestinal round-worm which is usually coupled with *Trichuris*, presents the greatest threat to under-five children both in terms of in-

cidence and intensity of infection. The hookworm infection was found to be rare, whilst taeniasis was not detected.

According to the factors described, the helminthiasis frequencies between inner and outer *banjars* were insignificantly different. This result can be attributed to the continuous influence between the two type of *banjars* which is all pervasive.

The periodical deworming suggested to be given in the nation-wide supplementary food programme to under-five children has already been launched.

#### REFERENCES

- Arfaa, F., Sahba, G. H., & Farahmandian, I. 1977 Evaluation of the effect of different methods of control of soil transmitted helminths in Khuzestan, South West Iran. *Am. J. Trop. Hyg.* 26:230-33.
- Clarke, M. D., et al. 1973 A parasitological survey in the Yogyakarta area of central Java, Indonesia. *S. E. A. J. Trop. Med. Publ. Hlth.* 4(2):195-201.
- Condon Paoloni, D., et al. 1977 Morbidity and growth of infants and young children in rural Mexican village. *Am. J. Publ. Hlth.* 67:651-6.
- Hunter, G. W., et al. 1976 *Tropical Medicine*, 5th. ed. W. B. Saunders Company, Philadelphia.
- Khalil, M. 1926 The relation between sanitation and parasite infection in the tropics. *J. R. Sanit. Inst.* 47:210-15.
- Mata, L. J. 1978 The malnutrition infection complex and its environmental factors. *Symp. Protein-Energy Malnutr.*, London.
- Noerhayati, S. 1979 Infeksi cacing usus pada anak-anak, in Fakultas Kedokteran U. G. M. (ed.): *Kumpulan Naskah Ilmiah Kesejahteraan Anak*, pp. 1-10.
- Peters, W. 1978 The prevalence of parasitology to human welfare today. in E. R. A. Taylor (ed.): *Symposia of the British Society for Parasitology*, pp. 25-41. Blackwell Publication, Oxford.
- Preston, S. H., et al. 1972 *Causes of Death: Life Tables for National Populations*. Seminar Press, New York.
- Rowland, M. G. M., Cole, T. J., & Whitehead, R. G. 1977 A quantitative study into the role of infection in determining nutritional status in Gambian village children. *Br. J. Nutr.* 37:441-50.
- White, G. F., Bradley, D. J., & White, A. U. 1972 *Domestic Water in East Africa*. University of Chicago Press, Chicago.
-