

The prevalence of *Strongyloides stercoralis* infection in rural population of Bali: A preliminary study

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Abstrak

Pada bulan Maret sampai September 1992 dilakukan studi potong lintang di empat desa yang berbeda iklim-geologis di Bali untuk mengetahui prevalensi infeksi *Strongyloides stercoralis* yang berkaitan dengan umur, gender dan kondisi iklim-geologis. Jumlah sampel sebanyak 2880 orang yang dipilih secara random stratifikasi bertahap berdasarkan umur dan gender. Larva *Strongyloides* pada sampel tinja diidentifikasi dengan teknik modifikasi Harada Mori biakan tinja. Hasil menunjukkan bahwa prevalensi infeksi *Strongyloides* sebesar 1,6%; prevalensi pada laki-laki sebesar 1,2% dan pada perempuan sebesar 2,1%, akan tetapi tidak terdapat perbedaan secara statistik menurut gender. Menurut umur juga tidak terdapat perbedaan secara bermakna. Prevalensi tertinggi (2,4%) terdapat pada anak-anak berumur 7-12 tahun, diikuti oleh yang berumur tujuh tahun atau kurang (1,6%), 18 tahun atau lebih (1,6%), dan 13-18 tahun (0,6%). Prevalensi infeksi *Strongyloides* berkaitan dengan iklim-geologis. Prevalensi infeksi *Strongyloides* tertinggi terdapat pada daerah tinggi dan basah (3,3%), diikuti daerah rendah dan basah (1,5%), daerah tinggi dan kering dan (1,0%), dan terendah di daerah rendah dan kering (0,9%). Dapat disimpulkan bahwa prevalensi infeksi *Strongyloides stercoralis* di Bali rendah dan berkaitan dengan jenis iklim dan geologis, akan tetapi tidak ditemukan kaitan dengan gender dan golongan umur. (Med J Indones 2001; 10: 174-7)

Abstract

A cross-sectional study was carried out from March until September 1992 in 4 different geo-climatic rural villages in Bali to assess the prevalence of *Strongyloides stercoralis* infection related to age, gender and geo-climatic condition. The number of selected samples using multistage stratified random sampling based on age and gender was 2880. *Strongyloides* larvae in stool samples were identified by modified Harada Mori fecal culture technique. The results showed that the overall prevalence of *Strongyloides* infection was 1.6%; the prevalence in male was 1.2% and in female was 2.1%, however the gender difference was not statistically significant. In term of age, there was no statistically significant difference. The highest prevalence (2.4%) was found among 7-12 years children, followed by aged 7 years or less (1.6%), 18 years or over (1.6%), and 13-18 years (0.6%). The prevalence of *Strongyloides* infection related to geo-climatic conditions was significantly difference. The highest prevalence of *Strongyloides* infection was at wet highland (3.3%), followed by wet lowland (1.5%), dry highland (1.0%), and dry lowland (0.9%). In conclusion, the prevalence of *Strongyloides stercoralis* infection in Bali was very low prevalence of *Strongyloides* infection was highly related to geo-climatic type of area, but not to gender and age groups. (Med J Indones 2001; 10: 174-7)

Keywords: *Strongyloides stercoralis*, geo-climatic condition, modified Harada Mori technique, rural population, Bali

Strongyloides stercoralis (*S. stercoralis*) is one of the intestinal nematodes of the soil-transmitted helminth group, the ova or larvae become infective after some time in the soil.¹ In developing countries, the number of surveys on *S. stercoralis* is much smaller than the number of surveys on other soil-transmitted helminth. This may be related to the fact that *Strongyloides* infection is rare in these countries compared to *Ascaris*, *Trichuris* and hookworm infection.² In some parts of the world, *Strongyloides* infection tends to

parallel hookworm infection, both in its geographical distribution and incidence. In some countries such as Brazil and Columbia, *Strongyloides* infection is more prevalent and hence more serious disease than hookworm infection, with a prevalence rate of 58% and 20% respectively. In other countries, however, prevalence of *S. stercoralis* is much lower than hookworm infection.² Whatever the level of prevalence, the life of *S. stercoralis* is very much similar to that of hookworm i.e. it is highly dependent on soil, sanitation and climatic condition.⁶

in some areas in Thailand and among Cambodian refugees in Thailand was 0.43% and 0.88% respectively.^{3,4} In Indonesia a very low prevalence of *Strongyloides* infection was reported in 1989 than the prevalence in 1956. In 1989 the prevalence was 9.4% among hospitalized patients and 16.3% among autopsies.⁵

S. stercoralis is an opportunistic parasite which becomes highly pathogenic in immune compromised patients such as among HIV patients, T cell leukemia patients, and in chronic diseases and after prolonged immunity-suppressing medication. In these cases the intestinal barrier decreases sharply resulting in massive invasion of L3 larvae which leads to hyperinfection and severe sepsis, which may cause death.^{7,8}

As the incidence of HIV infection is increasing from time to time, *Strongyloides* infection is becoming more and more important as a cause of health problems.

The present study aimed to identify the prevalence of *Strongyloides* infection in the rural population of Bali and to describe its relationship to age, gender and geoclimatic factors. The baseline data gathered from this study may be useful for the purpose of developing a control program against the infection.

METHODS

This cross-sectional study was carried out during dry season from March to September 1992. The study was conducted in four villages, representing the different geoclimatic types of Bali Island:⁹ (1) The village of Belumbang, in Sub-district of Kerambitan, 25 km west of Denpasar, capital of Bali. It has an elevation of 0 to 500 m above sea level with ecosystem basis of rice-fields, well irrigated all year around. The soil is of yellowish lactose type, consisted of volcanic debris. Average annual rainfall is 1,726 mm with 7 months of wet and one month of dry season. The average humidity and temperature are 75.9% and 27.4° Celsius. This village represents wet lowland area. (2) The village of Baturiti, in Sub-district of Baturiti represents wet highland area. It lies 50 km north of Denpasar with an elevation of 500-1000 m above sea level. Its ecosystem basis is mostly rice-fields, and the soil is of brown andotol type. Average annual rainfall is 2,857 mm with no months of dry season. The average humidity and temperature are 84.1% and 21.7° Celsius respectively. (3) The village of Kubutambahan, in Sub-district of Kubutambahan represents dry lowland area, located 100 km north of

Denpasar, at an elevation of 0-500 m above sea level. Its ecosystem basis is field-crops, no rice-fields, with soil of brown regosol type. Average annual rainfall of 980 mm, each with 4 months wet season and dry season. The average temperature is 28.0° Celsius. (4) The village of Batur Selatan at Sub-district of Kintamani represents dry highland area. It lies 70 km northeast of Denpasar, with an elevation of 1000 m above sea level. Its ecosystem basis is field-crops with no rice-fields, its soil is of humid regosol type. Average annual rainfall is 2,129 mm with 6 months of wet season and 5 months of dry season. The average humidity and temperature are 86.5% and 18.7° Celsius respectively.

The selected number of population sample was 2,880 persons, selected by multistage stratified random sampling technique, based on age and gender. Age was taken as one of the independent variable as it was known in hookworm infection that age was a contributing factor to the event and level of infection.¹⁰ While gender was taken as an independent variable because of the different socio-behaviors of men and women that are closely related to infection.¹¹

The presence of *S. stercoralis* larvae in stool of the study subjects were determined by modified Harada Mori fecal culture technique. All cultures and their assessment were done entirely in the laboratory of the Department of Parasitology, Faculty of Medicine, Udayana University, by 6 well-trained staff of the department (senior doctors and parasitologists). Before stools were collected from the selected individuals, we conducted a meeting with the local formal and informal leaders as well as the local field workers of each of the six selected villages. In the meeting we explained about the objectives and usefulness of the study, collection of stool samples from selected individuals, laboratory examinations done, and other related things. We asked the leaders and field workers to convey all the information to each of the study subjects.

All data collected were analyzed descriptively and analytically using chi-square test.

RESULTS

Of the selected 2880 samples, 2410 could be recovered and of these 2394 could be completely analyzed (16 were excluded due to incomplete data).

Table 1 shows that out of 2394 stool samples examined, and 39 were positive for *S. stercoralis* larvae, giving an overall prevalence rate of 1.6%. The prevalence rate in male was 1.2% and in female was 2.1%. However, the difference was not statistically significant.

Table 1. *Strongyloides stercoralis* infection and number of stool examined by gender, age group, and geo-climatic type

| | <i>S. stercoralis</i> infection positive | Number of examined | Pre- valence (%) | p |
|------------------------------|--|--------------------------|------------------------|-------|
| Gender | | | | 0.074 |
| Male | 9 | 1199 | 1.2 | |
| Female | 18 | 1195 | 2.1 | |
| Age group | | | | 0.108 |
| 7 years or lower | 8 | 504 | 1.6 | |
| 7-12 years | 17 | 699 | 2.4 | |
| 13-18 years | 3 | 496 | 0.6 | |
| 18 years or over | 11 | 695 | 1.6 | |
| Geo-climatic type | | | | 0.003 |
| Wet lowland | 18 | 539 | 3.3 | |
| Wet highland | 7 | 692 | 1.0 | |
| Dry highland | 5 | 549 | 0.9 | |
| Dry lowland | | | | |

Based on age groups, the highest prevalence (2.4%) was among 7-12 years children, followed by 7 years or lower (1.6%), 18 years or more (1.6%), and 13-18 years (0.6%). The prevalence differences were not statistically significant.

The prevalence of *S. stercoralis* infection related to geo-climatic conditions was significantly difference. The highest prevalence of *S. stercoralis* infections were at wet highland (3.3%), followed by wet lowland (1.5%), dry highland (1.0%), and dry lowland (0.9%).

DISCUSSION

In this study we did not specifically related environmental sanitation with the level of infection in the four different geo climatic areas, as in a previous study on hookworm infection on Bali we found no significant differences of sanitation condition in the four geo climatic areas (personal communication).

The overall prevalence of *S. stercoralis* infection in the rural population of Bali was 1.6%. In Surabaya the

prevalence was found to be 2-3%.⁷ In the Philippines the prevalence of *S. stercoralis* infection was 2.27%.² Preuksaraj et al.³ (1981) reported the prevalence of 0.43% in Thailand; and among Cambodian refugees in Thailand the prevalence was 0.88%.⁴ The prevalence of *S. stercoralis* infection in Bali was very low compared to the prevalence of hookworm infection. There is no doubt that the prevalence rate of *S. stercoralis* infection is much lower than hookworm infection almost anywhere, except probably in Brazil and Columbia. This is rather strange if we consider that *S. stercoralis* females are more prolific than hookworm females. In addition, the presence of free-living generation of *S. stercoralis* in soil, which does not occur in hookworm, would theoretically increase the number of larvae in the soil. There are two factors which can explain the difference. Firstly, the first stage larvae in feces may not be as resistant as hookworm eggs. Secondly, the filariform larvae of *S. stercoralis* may be more sensitive to drying, excess of moisture or mark change in temperature, hence a much shorter life span than hookworm filariform larvae.²

By age group and gender, the prevalence of *S. stercoralis* infection showed a controversial result. In this study the prevalence in female was higher then in male and prevalence among 7-12 years children were also higher compared to other age groups. This result agrees with Cabrera findings,² but contradicting with the report of Belding.⁶ According to geo climatic type of area, significant highest prevalence of *S. stercoralis* infection was found in wet highland, followed by wet lowland, dry highland and dry lowland. The explanation of this is that prevalence of *S. stercoralis* infection is parallel with prevalence of hookworm infection.^{2,8, 12} This may lead us to a conclusion that geo-climatic factors, such as soil textures, farming ecosystem, temperature, humidity and rainfall essentially influence the infection of *S. stercoralis*.

In conclusion, the prevalence of *Strongyloides* infection in the rural population of Bali was very low (1.6%) compared to the prevalence of hookworm infection. The highest prevalence of *Strongyloides* infection in Bali was at wet highland area. It was significantly related to geo-climatic types of areas, but it was not related to gender and age groups. It is recommended that a control action be undertaken with priority given to people in the wet highland areas of Bali.

Acknowledgments

We would like to thank the International Development Research Center (IDRC) Canada, for providing a grant aid for this study. Thanks are also due to Dr. Pandu Wijeyeratne for his assistance during the preparation of the study. We are indebted to Drs. Nengah Kapti, Luh Ariwati, Nyoman Wartana and Ketut Ngurah, for their assistance in several parts of the study. Lastly, we thank the village leaders, field workers and all subjects for their participating in this study.

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