Collected Papers on the Control of Soil-transmitted Helminthiases

by the APCO Research Group

Volume II

The Asian Parasite Control Organization

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APCO

The Editorial Committee

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PREFACE

In 1975, at the Second Conference of the Asian Parasite Control Organization (APCO) held in Tokyo, it was agreed that the integration of the "control of soil-transmitted helminthiasis and nutrition guidance" with family planning was the most important step for promoting family planning. Soon after the conference, this Integrated Project was put into practice. That was eight years ago.

Only five countries, namely, Indonesia, Korea, the Philippines, Taiwan and Thailand participated in this Project at first. Thereafter, Malaysia, Nepal, Bangladesh and Sri Lanka initiated the project. Currently (as of July 1983), in Asia, these nine countries are committed to the Integrated Project.

In 1977, a research grant system was established for the period of 1977 to 1979. This grant was established to improve implementation of the pilot projects for parasite control in the Integrated Projects in the above nine countries. In 1979, the First APCO Parasitologists' Meeting was held in Tokyo. The participants discussed the progress of the above pilot projects and exchanged opinions about future plans. Such meetings have been conducted annually in Tokyo, where recommendations are adopted for the further promotion of the Integrated Projects. These recommendations reflect fresh ideas and directions which have evolved through research, and which shape the future of the Integrated Project.

In order to introduce this information derived by research to other countries so that they can use it as a reference when they initiate a similar project, research data obtained in the initial three-year phase were published in a book titled "Collected Papers on the Control of Soil-transmitted Helminthiases, Vol. I" in 1980.

It was decided that the research projects should be continued for another three years from 1980 to 1982, as the second phase. At the Fourth APCO Parasitologists' Meeting in 1982, it was decided to publish the second volume of the Collected Papers to introduce the data and achievements of the second phase. The Meeting also decided to extend research to a third phase.

In the Volume I of the Collected Papers, the major contents concerned the fundamental research for the Integrated Projects. Included are such subjects as epidemiological studies on soil-transmitted helminthic infections in the respective project countries, standardization of fecal examination techniques for helminth eggs, drugs of choice, frequency and timing of mass treatment, evaluation methods of the effect of mass treatment, training of medical technicians, etc.

Achievements of the Integrated Project have captured the attentions of other countries and have been highly praised. In 1980, the Latin-American version of APCO Conference named "Conferencia Americana De Programas Integrados (CAPRI)" was conducted in Bogota, Colombia, where mainly representatives from Latin-American countries were invited. Furthermore, in 1980, an international seminar on the relationship between parasite control and malnutrition was held in Tokyo under the joint auspices of WHO, UNICEF, JOICFP and JAPC. In this seminar, the necessity of further investigations of how parasite control contributes to the improvement of nutrition was acknowledged.

It was decided that the second phase research should take up more practical and higher level problems. Accordingly, this volume (Vol. II) contains many original observations about control of soil-transmitted helminthiasis and should be valuable for the specialists. Volume II should also be very helpful in dealing with future problems. For example, regarding control of ascariasis, a more economical and effective method of selective mass treatment is discussed in detail.

Although studies have been conducted concerning the relationship between parasite control and nutrition and data from them is included in this volume, more research is needed and studies are expected to continue.

It has been demonstrated that determining effective timing and frequency of mass treatment of hookworm and *Trichuris* infections and subsequent evaluations are not as easy as for cases of ascariasis. It is also hoped that this problem will be studied further in future.

Needless to say, improving of environmental sanitation by means of mass treatment is essential to maximize the effectiveness of parasite control. Therefore, this volume also contains research on survey methodology and the prevention of environmental pollution with parasite eggs.

It is encouraging that the mass treatment itself is evaluated as an effective measures to conduct health education for the community and that these indirect benefits from mass treatment has drawn international attentions to our efforts.

On behalf of all the authors and contributors to this volume, I sincerely hope that Volume II will be as useful as Volume I, for various personnel related to the Integrated Project as well as experts in this field.

Lastly we would like to express our sincere thanks to the following organizations for their close cooperation in the research and preparation of this publication; the International Planned Parenthood Federation, the United Nations Fund for Population Activities, the United Nations Children's Fund, the World Health Organization, the Ministry of Health and Welfare and Ministry of Foreign Affairs of the Government of Japan. We would also express our greatest thanks to the many other related organizations and people who helped make the research reported in this volume possible.

Muneo YOKOGAWA
Chairman, Editorial Committee
August 1983

LIST OF RESEARCH PROJECTS FROM 1980 TO 1982

Country	Year	Research Themes	Principal Investigator	Japanese Counterpart
Bangladesh	1980 – 1982	A. Soil Pollution with *Ascaris lumbricoides* in Norsindi and Meradia, Bangladesh	Dr. M.A. Muttalib	Prof. Noriji Suzuki
	1980 – 1982	B. Seasonal Variation of *Ascaris* Infection in Rural and Urban Children	Dr. M.A. Muttalib	Prof. Noriji Suzuki
	1981 – 1982	C. Scatter Pattern of Parasitic Ova in the Around Selected Sample Houses in Urban and Rural Community, Bangladesh	Dr. M.A. Muttalib	Prof. Noriji Suzuki
Indonesia	1980	Effect of Treatment of Soil-transmitted Helminths on the Dispersion of *Ascaris* Eggs in Dust and Soil	Prof. Bintari Rukmono	Prof. Somei Kojima
	1981	The Influence of Nutrients Especially Vitamin A and Iron and Regular Deworming in Reference to Children Under-five	Prof. Bintari Rukmono	Prof. Somei Kojima
	1982	Worm Infestation and the Nutritional Status of Children Underfive	Prof. Bintari Rukmono	Prof. Somei Kojima
Korea	1980	Studies on the Control Problems of Ascariasis in Korea	Prof. B.S. Seo	Prof. Muneo Yokogawa
	1981	Analysis on the Mass Control Project on Students against *Ascaris* Infection in Korea	Prof. B.S. Seo	Prof. Muneo Yokogawa
	1982 – 1983	Epidemiological Study on Trichuriasis in Korea	Prof. B.S. Seo	Prof. Muneo Yokogawa
Malaysia	1982	A. Correlation between Intestinal Helminthiasis and Malnutrition	Dr. S.P.K. Chua	Prof. Muneo Yokogawa Dr. Noboru Kagei
	1980 – 1982	B. Epidemiological Studies Related to Source of Infection	Dr. S.P.K. Chua	Prof. Muneo Yokogawa Dr. Noboru Kagei
	1980 – 1982	C. Chemotherapy	Dr. S.P.K. Chua	Prof. Muneo Yokogawa Dr. Noboru Kagei

Country	Year	Research Themes	Principal Investigator	Japanese Counterpart
Nepal	1981 – 1982	Indigenous Drug Research	Dr. Gurubacharya	Prof. Seiichi Inatomi
Philippines	1979 – 1982	A Comparative Study on the Effect of Mass Treatment of an Entire Community and Selective Treatment of Children 0–14 years on the Prevalence of Soil-Transmitted Helminthiasis in Two Communities, Mindoro, Philippines	Prof. B. Cabrera	Dr. Shigeo Hayashi Prof. Hiroshi Tanaka
Sri Lanka	1981	Selection of a Suitable Single Dose Schedule for Mass Anthelmintic Treatment in Sri Lanka and an Assessment of Re-Infection Rates	Dr. M.M. Ismail	Prof. Kazuo Yasuraoka
	1982	A Study of the Pattern of Re-infection with Soil-transmitted Nematodes in Sri Lanka	Dr. M.M. Ismail	Prof. Kazuo Yasuraoka
Thailand	1980 – 1982	Study on the Toxicity of Ma-Klua Berry Juice Mixed with Coconut Milk	Dr. Manasvi Unhanand	Prof. Akio Kobayashi
Taiwan	1980 – 1981	A. Periodic Blanket Treatment of Both Pre-Schoolchildren and Schoolchildren in *Ascaris* Control	Dr. C.M. Wang	Prof. Masamitsu Ohtsuru
	1980 – 1981	B. The Fourth Year Periodic Mass Treatment for Ascariasis Control in Taiwan	Dr. C.M. Wang	Prof. Masamitsu Ohtsuru
	1977 – 1982	The Fifth Year Periodic Mass Treatment for Ascariasis Control in Taiwan	Dr. E.R. Chen	Prof. Masamitsu Ohtsuru

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CHAPTER VII. IMPLEMENTATION

CHAPTER I

EXAMINATION TECHNIQUES

Introduction

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The main target of parasite control by the Asian Parasite Control Organization (APCO), as is mentioned in the "Collected Papers on the Control of Soil-transmitted Helminthiases, Vol.I", are soil-transmitted helminths, particularly, *Ascaris*, hookworm and *Trichuris.*

Chapter I of the Vol. I contains papers, presented at the APCO/FP Conferences, Workshops and the APCO Parasitologists' Meetings which were held from 1974 to 1979, on such subjects as "methods of selecting the sample populations for understanding the condition of infection by helminths", "methods for evaluation of the effect" and "methods of fecal examination which are simple, sensitive and economical".

With regard to the fecal examination, it was recognized by APCO that the Cellophane Thick Smear Technique is the most appropriate and satisfactory qualitative method, which meets the three conditions, i.e. simplicity, high sensitivity and cost efficiency.

Since most quantitative evaluation methods are complicated and expensive, the Kato-Katz Technique or Modified Kato-Katz Technique, which utilizes the Cellophane Thick Smear Technique, has been widely accepted and praised.

Qualitative and quantitative techniques for mass fecal examination were considered standardized, based on the reports presented before 1979. These methods were adopted as major techniques for parasite examinations in the Regional Training Course on the Control of Intestinal Helminthic Infections with Special Emphasis on Soil-transmitted Helminthiases, Family Planning Practice and their Integrated Program which has been annually held in Bangkok since 1977.

After 1979, there were only a few reports concerning fecal examination method. Sinniah *et al.* (1981) examined and reported about the number of *Ascaris* ova discharged per day. It is one of the basic research subjects about quantitative methods.

However, when we discuss the control of a whole species of soil-transmitted helminthiases, the above two techniques, i.e. the Cellophane Thick Smear Technique and the Kato-Katz Technique are not adequate. The following research papers were presented during the period from 1980 to 1982.

1) Cultivation Techniques for Hookworm and *Strongyloides*

With the Cellophane Thick Smear Technique, some species of hookworm can not be identified by their eggs, and the identification of Rhabditisform larvae are very difficult for *Strongyloides stercoralis* and other nematodes which belong to Strongyloidea.

Although various cultivation techniques were investigated in the past, they were found to be inadequate for mass examination because of their complicated procedures and high cost.

The filter-paper cultured technique (Harada-Mori Culture Technique), devised by Harada and Mori in 1955 and partially modified by Sasa *et al.* (1958), has proved to be the most efficient examination technique for hookworm and *Strongyloides*. Therefore, it has been used in various countries for many years.

However, this method was yet rather costly for developing countries, since it used expensive glass tubes. Then, Sasa *et al.* (1965) tried to substitute cheaper polyethylene tubes for the more costly glass tubes and obtained almost the same results in detecting larvae. With this finding, this method became a superior examination technique for mass examination.

Cabrera (1981) used this technique in the Philippines for the identification of hookworm species and the detection of *Strongyloides stercoralis* and obtained very interesting results. It is hoped that other countries will also consider using this technique.

2) Technique for the Measurement of Environmental Pollution with Infective Stages of Soil-transmitted Helminths

Mass examination and mass treatment are the basic measures for controlling the soil-transmitted helminths infection. Further, to prevent infection it is important to know the seasonal variations of incidence of infection and infective stage of the soil-transmitted helminths.

The basic framework and methodology of research on the seasonal variations were elaborated by Kobayashi (1982, Appendix-2 in Chapter II). Regarding the survey techniques used in measuring environmental pollution, Kagei (1982, Appendix-1 in Chapter I) reviewed the past literature.

Several surveys were already conducted on environmental pollution, such as nail and dust in Indonesia by Ismid *et al.* (1981, Chapter IV), vegetables sold in markets in Kuala Lumpur by Sinniah (1982, Chapter II), and nail, dust, soil and vegetables in the slum of Bangkok by Sornmani *et al.* (1980, Appendix-5 in Chapter IV). Although it was reported that helminth ova were detected in all cases, the data were not analyzed further.

Evaluating the Reliability of Egg Counts in Determining Intensity of *Ascaris* Infections†

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INTRODUCTION

It is generally accepted that the prevalence and intensity of ascariasis are highest in the younger age groups. This is probably due to such factors as lack of natural or acquired resistance and differences in behaviour and occupation between children and adults. The intensity of infection can be determined in the individual by counting worms recovered at autopsy, worms recovered after anthelmintic treatment or eggs passed per unit of faeces. Over the years a large volume of information has accumulated on the host-parasite relationship of *Ascaris lumbricoides*. Several workers have tried to relate egg counts to the number of worms present (Brown and Cort, 1927; Augustine *et al.*, 1928; Farid *et al.*, 1966; Delgado *et al.*, 1970; Mello, 1974; Sinniah *et al.*, 1980). They indicated the egg counts in terms of number per gram of faeces. The methods devised for making egg counts in the faecal samples are of 3 types – direct smear, dilution and concentration. It was found that helminth eggs are randomly scattered in the stools and that the eggs though introduced into the faecal streams at the same time are not usually passed out at the same time but at irregular intervals, as much as several hours apart (Martin, 1965). Egg counting is still important in estimating the worm load and in assessing the efficacy of treatment. The number of eggs in a faecal sample reflects the number of egg-laying females present and not the total number of worms. A sex ratio of 1:1 is often assumed.

The aim of this study is to determine the daily egg output by a female *Ascaris*. The distribution of eggs in the faeces and sex ratios of worm burden was estimated.

MATERIALS AND METHODS

A study was carried out among school-children in primary schools in Kuala Lumpur, Malaysia. A total of twenty Indian children (9 females and eleven males) aged 6-12 years from a low socio-economic background with poor nutritional status were studied. All had *Ascaris* infections. The subjects were examined for the presence or absence of symptoms and faecal examinations were carried out using Brine flotation technique. If the stools were positive the Katz's modified thick smear technique was applied (Katz *et al.*, 1972; Suzuki *et al.*, 1977). Stool passed by each of the 20 subjects was collected for 24 hours and weighed. From the weight of the stool and the E.P.G., the number of adult female worms was estimated using the method of Brown and Cort (1927). A sub-sample of faeces from all positive cases were used to estimate the number of eggs per gram of stool (E.P.G.) using Katz's modified thick smear technique.

In another study all stools passed daily was collected in separate buckets for seven consecutive days to determine the concentration of eggs within a stool sample and to find out whether the female worm lays a consistent number of eggs daily.

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†: Presented at the Third APCO Parasitologists' Meeting, 1981