

# FOOD- AND WATER-BORNE PARASITIC ZOOSES IN THE 21<sup>ST</sup> CENTURY

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## BACKGROUND

This, the third in a series of Seminars, had as its theme the prospects for improved mitigation of food (and water)-borne parasitic zoonoses (FBPZ) in the coming decade. The instigation of this series of conferences focusing on Asia, grew out of a recognition in the 1980s that problems related to FBPZ, when considered in the aggregate, were substantial, and for this region, appeared to be increasing in spite of economic growth and development. Concern existed over the unpredictable consequences of population growth and development, forces which can have an impact on food production systems, the demands for water, and which can cause dramatic demographic and social changes such as urbanization, travel, immigration, and political shift. The importance of these factors lies in their potential adverse influences on the Human-Domestic animal-Wildlife diseases continuum characteristic of zoonoses. Obvious examples are the movement of people and animals, the creation of water catchments for agriculture and power, and because of increased demand for meat (especially exotic foods), intensification of livestock production, with their impacts on water safety and environmental quality. Thus, these FBPZ meetings were created around specific objectives: (1) To determine the extent of FBPZ, especially in Asia; (2) to stimulate greater epidemiological study; (3) to identify and address research needs; and (4) to facilitate the development of practical and sustainable control projects. The Seminar organizers also wanted the opportunity to increase collaboration between researchers and public health workers throughout the region (and world), to improve access to knowledge and data on the status of FBPZ in various countries, and to raise the visibility and awareness of FBPZ both within and outside of the scientific community.

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Looking back from this 3<sup>rd</sup> Seminar to the 1<sup>st</sup> Seminar in 1990, it is clear that much has been achieved in meeting the original objectives. The presentations and discussions at this meeting reflected major advances in the understanding of the epidemiology of FBPZ in the region, in devising effective educational tools and strategies, in the development of reliable diagnostic tools, in vaccine development for certain zoonoses, and in the development of new approaches to effective control. The latter was especially prominent at this meeting, reflecting the maturing of the FBPZ research agenda. The following are only a few highlights pertaining to these aspects. Because of the large number of participants (over 600), it is beyond the scope of this brief report to summarize all of the presentations and discussions. A complete record of the papers and lectures for this 3<sup>rd</sup> Seminar will be published in 2001 by the *Southeast Asian Journal for Tropical Medicine and Public Health*.

## CONTROL PROJECTS

The Seminar was opened by the Vice-President of Mahidol University, Professor Somwang Dan-chaiwijittr, who emphasized the need for comprehensive approaches to the study and control of FBPZ. This was supported in the keynote address (The Sixth Chamlong-Tranakchit Harinasuta Lecture) by Dr Lorenzo Savioli (WHO), who also cited the need for multidisciplinary efforts. He reminded the participants of the demonstrated effectiveness of mass chemotherapy programs, especially for school children, when coupled with operational research to clarify the correlation between intensity of infection and morbidity. Currently, WHO and its partners are working for the creation of a private-public coalition to scale-up helminth control at the global level, adapted to regional and country conditions.

From the Seminar's discussions, certain elements necessary for effective control programs have emerged: (1) Sustainability; (2) operational research; (3) multidisciplinary composition; (4) consistent and reliable surveillance and reporting; and (5) linkage to

general food and water safety programs. The latter is especially important in countries with limited resources, and it reinforces the relevance of FBPZ to broader public health programs.

Among the promising control projects presented was the Pak Mun Dam Control and Surveillance Program (Thailand), which was organized before completion of the dam and the creation of the large impoundment. Pre-catchment base-line parasitological data (both human and animal), human water contact behavior studies, health education, and annual health examinations (and treatment if needed) are important elements of this program's efforts to mitigate any dam-related increases in parasites, especially *Schistosoma mekongi* and fish-borne helminths. Another project with substantial effect is the Hokkaido (Japan) *Echinococcus* Control Program. This fox-bait deworming program, covering 200 km<sup>2</sup>, has witnessed a reduction in prevalence from 17.8% to near zero in the control area, based on coproantigen and fecal egg assays. In another example, progress has been made in a *Clonorchis sinensis* control project in Jiangxi (China) using a multicomponent approach. This area has seen an increase in infections related to rising affluence and the demand for raw fish delicacies. The approach adopted to control infection includes mass drug treatment, periodic pond clean-out, and health education, especially on food risk and preparation. To date, this program has driven down the human prevalence from 65% to 19% in two years. One lesson learned is that changing people's diet and farming habits is a demanding, long-term challenge.

In Nepal a multistep approach to encourage and support living conditions conducive to good health is being implemented. The model, termed PRECEDE-PROCEED, requires an initial social and epidemiological assessment to determine the magnitude of the problem. Next, assessments of risk factors, such as the practices of meat producers, meat processors, and food preparers are carried out. Particular effort is placed on determining necessary predisposing, reinforcing and enabling factors required for FBPZ control. Finally, regulatory and administrative requirements are determined, along with appropriate legislative authorities. The information obtained through the use of this model is being incorporated into the design of a *Taenia solium* control program; if successful, the model will be used for a broader attack on other FBPZ.

Over the past decade, a number of projects have been conducted in Thailand and Vietnam for the control of fish-born trematodes (*Clonorchis*, *Opisthorchis* and *Paragonimus*). These have been assisted by both WHO

and FAO and have been based on the HACCP concept to control infections. These on-going efforts, while too early to assess the long-term results, are promising based on the success of HACCP programs elsewhere, in generating effective management options.

These selected examples reflect the increasing emphasis now being given to moving control tools and concepts into the field in pilot and demonstration projects. The experiences gained from these efforts should be a focus topic for a 4<sup>th</sup> FBPZ Seminar in 2005.

## EPIDEMIOLOGY

Epidemiological studies were again a major topic at this Seminar. New information on the distribution, biology and zoonotic potential of *Giardia* and *Cryptosporidium* provide a much clearer picture of the importance of these parasites. Molecular epidemiology investigations reveal that the genetic diversity of *Giardia* is associated with different transmission cycles, some of which are unequivocally zoonotic. The taxonomy of the complex of genotypes will undoubtedly be further clarified in the near future. Relevant to control, a new vaccine for *Giardia* in animals was described. The complex of cryptosporidia genotypes was also reviewed, and similar distinctions are now possible for those types with significant zoonotic potential. Without question, these advances make national epidemiological surveillance systems possible and enhance the understanding of the biology and public health risk of these water-borne parasites. Based on the presentations made, the research on other water-borne protozoa is less-well advanced and much is yet to be done. The ability to detect and characterize the microsporidia, as well as *Cyclospora*, remains a priority because of importance for epidemiological studies. This is of special importance to *Cyclospora* endemic countries like Nepal where hundreds of cases of the parasitosis are seen each year.

The persistence and emergence of helminth zoonoses was addressed by many presenters. It was pointed out that, because of unawareness on the part of clinicians/practioners, parasite zoonoses are frequently misdiagnosed, often as malignant diseases. For example, it was calculated that the cost for misdiagnosis of liver lesions due to ascarid VLM or liver fluke as cancers, can be very costly. Paragonimiasis mis-diagnosed as tuberculosis is also of great concern. Angiostrongyliasis cantonensis spread to the western hemisphere is an especially difficult diagnosis to make by inexperienced physicians. Hospital stays for extensive examinations in Japan may cost US\$ 3,000, whereas a fecal examination or

immunodiagnosis for zoonotic helminths costs less than US\$ 50. Multiple dot (antigens) ELISA tests in the hands of clinicians and public health laboratories could markedly increase the detection, reporting and treatment of FBPZ.

The value of national or international reference centers for FBPZ was demonstrated repeatedly throughout the Seminar. An excellent example is the International Trichinellosis Reference Center in Rome. Because of the expertise and collections in this Center, the understanding of the systematics and epidemiology of *Trichinella* has improved dramatically in the last 10 years. Similar international (or national) reference centers for other major FBPZ would be a tremendous help to epidemiologists and disease control entities.

#### MOLECULAR AND IMMUNOLOGICAL RESEARCH

The advances made over the past decade in the immunodiagnosis of parasites such as *T.solium*, *Toxoplasma*, *Trichinella*, *Paragonimus*, *Echinococcus*, have been remarkable. In many cases, the sensitivity and specificity levels are sufficient to meet the needs

for epidemiological and control efforts. This was certainly not the case at the 1<sup>st</sup> Seminar, where the problems of diagnosing cysticercosis was a major topic of discussion. However, from the presentations at the Seminar, the progress has been tremendous and limitations on developing adequate surveillance and control programs are few.

Reports on the genomics of selected parasites were heard for the first time in this Seminar series. These initiatives, although still in their early stages, can be expected to renew vaccine development efforts (eg *Schistosoma japonicum*, *Fasciola hepatica*, *F. gigantica*). A number of papers were presented on DNA and recombinant antigen vaccines for *S. japonicum*, *T. solium* cysticercosis, *Fasciola* spp, and *Entamoeba histolytica*. Although progress is variable in this very difficult field, success will be very welcome provided the obstacles associated with commercialization and affordability can be overcome.

This 3<sup>rd</sup> PBPZ Seminar re-inforces the need for continuous efforts to determine the prevalence, distribution, treatment and control of food- and water-borne parasitic zoonoses. The success of this Seminar illustrates the progressive interest in the series, and it was suggested that because of the importance and need the Seminars should be held more frequently.