



**MINSANTE**  
Ministère de la Santé Publique



**CENTRE SCHISTOSOMIASIS  
& PARASITOLOGY**

Under the patronage of  
The **MINISTER OF PUBLIC HEALTH** and The **MINISTER OF BASIC EDUCATION**

# TES CONFERENCE 2017

## TOWARDS ELIMINATION OF SCHISTOSOMIASIS

*a paradigm shift*

Hotel Mont Fébé  
Yaoundé - Cameroon

22 - 23 March 2017



**BACKGROUND  
& AGENDA**

## Welcome Note

Dear Colleagues,

Welcome to the First Conference organized on Schistosomiasis in Cameroon, entitled "Towards Elimination of Schistosomiasis: a paradigm shift", with as short acronym "TES Conference 2017". The Conference will bring together scientists, experts, donors, policy makers, non-governmental development organizations and students from all over the world to share and learn from each other's experiences and perspectives.

The TES Conference 2017 will provide a platform to access all that is new, evolving, challenging, successful and exciting in schistosomiasis control and elimination. We have several special guests and international delegates from more than 15 countries and international organizations and institutions, including WHO, Merck, GSA, China/Jiangxi CDC, LSTM, NHM, and CSP.

The control of Schistosomiasis is a long struggle, and examples of successes in several countries are encouraging. China has a vast experience in this domain, and we are grateful to have a Chinese delegation to this premier gathering.

We look forward to hearing from our keynote speakers, who are global leaders in their respective focus on schistosomiasis morbidity, diagnosis, control/elimination, monitoring & evaluation, and surveillance.

In addition, we have organized a one-day intensive training workshop to stimulate publication writing from our junior researchers, and to strengthen their knowledge in bioinformatics and epidemiology.

Lastly, we are grateful to our supporters. Please check the Conference Agenda and attend all sessions this meeting offers.

Welcome to Yaoundé and TES Conference 2017.



**Prof. Louis-Albert Tchuem Tchuente**

*Chair of Organising Committee*

*Président du Comité d'Organisation*



The TES Conference 2017 is under the patronage of  
The Minister of Public Health, **H.E. André Mama Fouda**,  
and  
The Minister of Basic Education, **H.E. Yousseuf Hadidja Alim**



**H.E André Mama Fouda**  
Minister of Public Health

*President of the National Steering  
Committee for SCH control*



**H.E Yousseuf Hadidja Alim**  
Minister of Basic Education

*Vice-President of the National Steering  
Committee for SCH control*











## *Organising Committee*

### *Chair:*

Prof. Louis-Albert Tchuem Tchuente

### *Members:*

Prof. Roger Moyou-Somo  
Dr Alain Georges Etoundi Mbella  
Prof. Anne-Cécile Zoung-Kanyi Bissek  
Prof. Russell Stothard  
Prof. David Rollinson  
Dr Jutta Reinhard-Rupp  
Dr Lorenzo Savioli  
Dr Mike Hseih





# TES CONFERENCE 2017

TOWARDS ELIMINATION OF SCHISTOSOMIASIS

*a paradigm shift*



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# Background

Schistosomiasis constitutes an important public health problem in developing countries and has major health and socio-economic repercussions. The disease is prevalent especially in communities without access to clean and safe drinking water, and adequate sanitation. It is estimated that 779 million people are at risk of infection, and some 250 million people are currently infected worldwide, with about 92% living in sub-Saharan Africa. In Cameroon, it is estimated that around 5 million people are at risk of infection with 2 million people currently infected.

*Towards Elimination of Schistosomiasis (TES) Conference is a premier gathering in Cameroon for all stakeholders working to overcome the impact of schistosomiasis. It will bring together scientists, experts, donors, policy makers, nongovernmental development organizations and students from all over the world to share and learn from each other's experiences and perspectives.*

*The conference will provide a platform to discuss progress, challenges and strategies in shifting from a morbidity control approach to elimination of schistosomiasis.*

As part of the global response to control morbidity of this disease, the World Health Assembly resolution 54.19 of 2001, WHO's governing body, recommended that Member States regularly treat all at-risk school-aged children with praziquantel to reach a minimum of 75% coverage. 2012 was a turning point for schistosomiasis with the approval of WHA resolution 65.21 on elimination of schistosomiasis and the expansion of the praziquantel donation. The WHA resolution encourages: "Member States and the international community to make available the necessary and sufficient means and resources, particularly medicines, and water, sanitation, and hygiene interventions, to intensify control programmes in most disease-endemic countries and initiate elimination campaigns, where appropriate". In 2007 Merck KGaA signed the first agreement with WHO for praziquantel donation and in 2012, the same year of the approval of the elimination resolution, its expansion by 2016 to 250 million tablets a year, equivalent to 100 million doses a year for school-age children in Africa. Today, with increased access to anti-schistosomal treatment and a new framework towards transmission control and elimination we are assisting in a growing momentum to move from morbidity control towards elimination of schistosomiasis in Africa. This is set within an increase in African governments' commitment towards achieving the World Health Organisation 2020 roadmap targets working towards a continent free of schistosomiasis by 2025. However, shifting from morbidity control to transmission elimination raises new challenges and points for consideration that we will address during this Conference with colleagues, experts and stake holders from endemic countries and the international community.

The TES Conference in Cameroon will bring together scientists, experts, donors, policy makers, researchers, non-governmental development organisations and students from all over the world to share and learn from each other's experiences and perspectives. The theme of this conference is

## ***"Towards Elimination of Schistosomiasis: a paradigm shift"***

This first international conference on schistosomiasis organized in Cameroon is under the patronage of the Minister of Public Health and the Minister of basic Education.



# Programme

The TES Conference will have a broad agenda that appeals to all participants involved in schistosomiasis research, control and elimination. The meeting will be centred around four main sessions that will focus on a range of tracks, each of which will be chaired by renowned experts in the field.

The four main sessions will focus on the following aspects:

- 1) **Control and elimination of schistosomiasis.**
- 2) **Morbidity, Female Genital Schistosomiasis (FGS) and Treatment.**
- 3) **Schistosomiasis surveillance, M&E and diagnostics.**
- 4) **Integrated Strategies for Schistosomiasis Control and Elimination.**

The meeting will start with an official opening session including key-note speeches on Wednesday, March 22nd 2017, followed by plenary talks, discussions, and poster sessions organised along the tracks and themes.

During lunch breaks (13:00 - 14:00) and in the evenings (17:00 - 18:00), the floor is open to poster presentations and a panel-led discussion will conclude proceedings.

*For more details, see the Conference Agenda (page 10).*

## Training

A side event training workshop for lecturers, researchers, students and laboratory technicians will be organized on Friday 24<sup>th</sup> March 2017 on publication writing, Bioinformatics and Epidemiology.

The agenda of the workshop is detailed on **page 14**.

## Method work

The structure of the conference consists of plenary presentations, panel-led discussions, and poster sessions.

## Language

The main language used during the conference is English.



# About Cameroon and Venue

## Welcome to Cameroon

**Cameroon** is a country in Central Africa. It is bordered by Nigeria to the west; Chad to the northeast; the Central African Republic to the east; and Equatorial Guinea, Gabon, and the Republic of the Congo to the south. Cameroon's coastline lies on the Bight of Biafra, part of the Gulf of Guinea and the Atlantic Ocean.

French and English are the official languages of Cameroon. The country is often referred to as «**Africa in miniature**» for its geological and cultural diversity. Natural features include beaches, deserts, mountains, rainforests, and savannas. The highest point at almost 4,100 metres (13,500 ft) is Mount Cameroon in the Southwest Region of the country, and the largest cities in population-terms are Douala on the Wouri river, its economical capital and main seaport, Yaoundé, its political capital, and Garoua.

Early inhabitants of the territory included the Sao civilisation around Lake Chad and the Baka hunter-gatherers in the southeastern rainforest. Fulani soldiers founded the Adamawa Emirate in the north in the 19th century, and various ethnic groups of the west and northwest established powerful chiefdoms and fdoms.

Cameroon enjoys relatively high political and social stability. This has permitted the development of agriculture, roads, railways, and large petroleum and timber industries.



### CITY OF YAOUNDÉ

**Yaoundé** is the capital of Cameroon and, with a population of 865 642, the second largest city in the country after the port city Douala. It lies in the Centre Region of the nation at an elevation of about 750 metres (2,500 ft) above sea level.

Most of Yaoundé's economy is centered on the administrative structure of the civil service and the diplomatic services. Due to these high-profile central structures, Yaoundé enjoys a relative higher standard of living and security compared to the rest of Cameroon.

The city centre houses government offices, some hotels, and the central market. The Bastos district, with most homes owned by Cameroonians, is home to foreign embassies and the expatriate European, American and other continental communities (drawn mainly from the diplomatic corps). The presidential palace and compound is in the Etoudi district.

Yaoundé Nsimalen International Airport is a major civilian hub, while nearby Yaoundé Airport is used by the military. Train lines run west to the port city of Douala and north to N'Gaoundéré. Many bus companies operate from the city; particularly in the Nsam and Mvan districts. Frequent buses run on the road between Yaoundé and Douala.



## Conference Venue

The event will take place at

### Hotel Mont Fébé

Yaoundé - Cameroon  
on 22 - 23 March 2017



## Useful Information



### Entry Visa

Foreigners are subjected to an Entry Visa in Cameroon. This visa must be obtained from the Embassy of Cameroon in the country of origin.

For those who do not have the Embassy of Cameroon, kindly contact the secretariat to obtain the Visa of Entry at the check in site.

It is imperative that residents or foreigners of countries having Cameroonian embassies or consulates obtain an entry visa prior to their departure. Obtaining the Visa of Entrance to the airport is strictly forbidden for them.

TES Conference declines any responsibility for failure to comply with this directive



### Transport

Transportation from the airport to the conference venue will be provided by the hotel's shuttle.

If you are traveling through the city of Douala, you will take a bus to Yaoundé.

Transportation in the city is provided by Taxis.

The taxis are in yellow color and cost 2 500 CFA francs for a single hire or 3 000 frs CFA per hour.

It is highly recommended to use taxis recognized by the hotel (please ask at the hotel reception of more info).

For safety reasons, avoid walking alone very late in the evening, carrying valuables gadgets or an impressive sum of money.

For any information or reservation, please contact the secretariat.

### Accommodation

Participants will be accommodated at the Mont Fébé hotel where rooms are already reserved for them.

The cost per room is negotiated at 69 000 CFA francs including tax per night.

Each participant is responsible for paying all incoming accommodation and all extras and meals during the conference prior to departure.







7:00 - 9:00	<b>REGISTRATION</b>	Secretariat
9:00 - 11:00	<b>OPENING CEREMONY</b> <ul style="list-style-type: none"> <li>• Welcome word</li> <li>• Partners' remarks</li> <li>• Opening speech by the <b>Minister of Public Health</b></li> <li>• Administrative and Security Briefing</li> <li>• Setting the Scene: <ul style="list-style-type: none"> <li>o Meeting Objectives</li> <li>o Overview of Schistosomiasis Control / Elimination in Cameroon: Achievements, Challenges and Ways Forward</li> <li>o Introduction of the Innovative Atlas of Schistosomiasis and Soil-Transmitted Helminthiasis Transmission in Cameroon</li> </ul> </li> <li>• Group photo</li> </ul>	<b>Conference Chair</b> <b>Dr Jutta Reinhard-Rupp</b> (Merck, Switzerland) <b>Prof. Jia Tiewu</b> (WHO AFRO) <b>H. E. André Mama Fouda</b> <b>Organising Committee</b>  <b>Prof. Louis-Albert Tchuem Tchuente</b> (Cameroon)
11:00 - 11:30	<b>HEALTH BREAK</b>	All
<b>Session 1</b>	<b>CONTROL AND ELIMINATION OF SCHISTOSOMIASIS</b>	Chairs: Dr Jutta Reinhard-Rupp and Prof. Roger Moyou
11:30 - 12:00	<b>Schistosomiasis elimination: progress and challenges</b>	Prof David Rollinson (United Kingdom)
12:00 - 12:30	Progress in Schistosomiasis and Soil-Transmitted Helminthiasis Control in Cameroon	PNLSHI
12:30 - 12:45	Impact of the annual mass drug administration of Praziquantel on Schistosomiasis transmission in Cameroon	Calvine Noumedem Dongmo (Cameroon)
12:45 - 13:00	Impact of the systematic school-based deworming program on schistosomiasis endemicity level and morbidity in the <i>Schistosoma mansoni</i> focus of Yorro, Bafia health district, Cameroon	Prof Roger Moyou (Cameroon)
13:00 - 14:00	<b>LIGHT LUNCH AND POSTER SESSION</b>	All
14:00 - 14:15	Prevalence and Intensity of infection with <i>Schistosoma mansoni</i> infection in four villages in the Adamawa Region of Cameroon after repeated mass treatment with praziquantel	Dr Romuald Isaka Kamwa Ngassam (Cameroon)
14:15 - 14:30	Schistosomiasis among school age children in Ipogun area of Ondo State, Nigeria: update on prevalence following several years of annual treatment	Dr Emmanuel Taiwo Idowu (Nigeria)



14:30 – 14:45	Epidemiology of urinary schistosomiasis in rural communities of Ovia South West local government area of Edo State, Nigeria	Ms Rukeme Marianne Noriode (Nigeria)
14:45 – 15:00	<i>Schistosoma haematobium</i> infection associated with Plasmodium falciparum infection burden in school aged children living in the vicinities of Lambaréné, Gabon	Dr Jean-Claude Dejon Agobé (Gabon)
15:00 – 15:15	<i>Schistosoma haematobium</i> group; genetics, epidemiology and biological complexities - impact on control	Dr Bonnie Webster (United Kingdom)
15:15 – 15:30	Developing an intensified intervention framework and appropriate environmental surveillance framework to guide the interruption of schistosomiasis transmission	Prof Russell Stothard (United Kingdom)
15:30 – 15:45	May hybrid schistosomes impair schistosomiasis control?	Dr Jerome Boissier (France)
15:45 – 16:15	Moving from control to elimination of schistosomiasis in sub-Saharan Africa: time to change and adapt strategies	Prof Louis-Albert Tchuem Tchuente (Cameroon)
16:15 – 17:00	Discussions	All
17:00 – 18:00	<b>HEALTH BREAK AND POSTER SESSION</b>	All

### Session 2

### MORBIDITY, FEMALE GENITAL SCHISTOSOMIASIS (FGS) AND TREATMENT

Chairs:  
by Dr Alain Etoundi and  
Prof Russel Stothard

8:30 - 9:00	Female-genital schistosomiasis - a holistic approach	Prof Hermann Feldmeier (Germany)
9:00 - 9:15	The Paediatric Praziquantel Consortium - helping children with Schistosomiasis	Dr Elly Kourany-Lefoll (Switzerland)
9:15 - 9:30	In vitro and in vivo efficacy of <i>Sida pilosa</i> Retz against <i>Schistosoma mansoni</i> -induced pathology	Dr Hermine Boukeng Jatsa (Cameroon)
9:30 - 9:45	Changes in seminal HIV-1 RNA load after praziquantel treatment of urogenital schistosomiasis in HIV positive men – a pilot study	Prof Nicholas Midzi (Zimbabwe)
9:45 - 10:00	Improving surveillance of Female Genital Schistosomiasis (FGS): Validating home-based cervical and vaginal self-sampling for detection of FGS in Zambian women with and without HIV seroconversion	Dr Amaya Bustinduy (United Kingdom)
10:00 - 10:15	Epidemiological and ultrasonic profile of uro-genital schistosomiasis in Barombi Kotto	Prof Roger Moyou (Cameroon)
10:15 - 10:30	Discussions	All
10:30 - 10:45	<b>HEALTH BREAK</b>	All

### Session 3

### SCHISTOSOMIASIS SURVEILLANCE, M&E AND DIAGNOSTICS

Chairs:  
Dr Michael Hsieh and  
Dr Neil David Young

10:45 - 11:05	CAA and CCA detection in schistosomiasis: ASSURED diagnostic tools to be employed when moving from control to elimination	Dr Govert van Dam (Netherlands)
11:05 - 11:25	Development of an interleukin-4-inducing principle from <i>Schistosoma mansoni</i> eggs (IPSE)-specific PCR assay as a quantitative predictor of schistosomiasis-associated morbidity	Dr Michael Hsieh (United States)
11:25 - 11:40	Evaluation of Circulating Cathodic Antigen (CCA) Urine-Tests for the diagnosis of <i>Schistosoma guineensis</i> infection	Gwladys Nelly Djomkam Chuinteu (Cameroon)
11:40 - 11:55	An M&E Framework for Schistosomiasis	Dr Fiona Fleming (United Kingdom)
11:55 - 12:15	Precision mapping: an innovative tool and new way forward to enhance the elimination of schistosomiasis in Cameroon.	CSP/PNLSHI (Cameroon)
12:15 - 13:00	Discussions	All
13:00 - 14:00	<b>LIGHT LUNCH AND POSTER SESSION</b>	All



### Session 4

### INTEGRATED STRATEGIES FOR SCHISTOSOMIASIS CONTROL AND ELIMINATION

**Chairs:**  
Dr Fiona Fleming and  
Prof Flobert Njiokou

14:00 – 14:15

Experience of China in national Schistosomiasis elimination programme. Updating Jiangxi – Cameroon Cooperation for Schistosomiasis elimination

Jiangxi Province Team (China)

14:15 – 14:30

Snail control and Schistosomiasis elimination

Prof Jia Tiewu (WHO AFRO / ESPEN)

14:30 – 14:45

Genomic tools to support schistosomiasis research

Dr Neil David Young (Australia)

14:45 – 15:00

Community Engagement is Essential for Behavioral Change and Control of Schistosomiasis

Mr Noam Assouline (Israel)

15:00 – 15:15

*Biomphalaria camerunensis* (Gastropoda: Planorbidae) as an alternative host of *Schistosoma mansoni* in the Southern Cameroon

Alvine Christelle Kengne Fokam (Cameroon)

15:15 – 15:30

Detection of hybrid *Schistosoma haematobium* group species in Cameroon by PCR-RFLP of the second internal transcribed spacer ITS-2

Dr Deguy D'or Luogbou Nzu (Cameroon)

15:30 – 15:45

Challenges associated with the use of Praziquantel for eradication of Schistosomiasis in Nigeria: the urgent need for vaccine development

Dr Amase Nyamngee (Nigeria)

15:45 – 16:00

Schistosomiasis Elimination: PHASE Approach and Research Priorities

TBD

16:00 – 16:30

Discussions

All

### PANEL DISCUSSION, CONCLUSION AND WAYS FORWARD

**Moderator:**  
TBD

16:30 – 17:30

PANEL DISCUSSION

Prof Jia Tiewu  
Dr Jutta Reinhard-Rupp  
Prof Moyou Roger  
Prof David Rollinson  
Prof Hermann Feldmeier  
Dr Govert van Dam  
Jiangxi Province Representative

CONCLUSIONS AND WAYS FORWARD

17:30 – 18:00

CLOSING OF THE CONFERENCE

### Paper Writing & Training Workshop

7:00 - 9:00	<b>REGISTRATION</b>	Secretariat
9:00 - 9:30	Opening remarks  Group Photo	Prof Louis-Albert Tchuem Tchuente (Cameroon) & Prof Russell Stothard (United Kingdom)
9:30 - 11:00	<b>Paper Writing</b>  • Scientific Writing and Submission Approach to the PLoS NTD • Overview of the of peer-review publication  • Q & A	Prof Louis-Albert Tchuem Tchuente (Cameroon) Prof. Russell Stothard (United Kingdom)
11:00 - 11:30	<b>HEALTH BREAK</b>	All
11:30 - 13:00	<b>Molecular Epidemiology</b> • Schistosome and snail identification • Molecular Diagnostics	Dr Bonnie Webster (United Kingdom)
13:00 - 14:00	<b>LAUNCH</b>	All
14:00 - 17:00	<b>Genetic and Bioinformatics</b> • Use of bioinformatics to support parasite research • Sanger sequencing and phylogenetic analysis • Epidemiological analysis	Dr Neil David Young (Australia) Dr Suzy Campbell (United Kingdom)
17:00 - 17:30	<b>Q &amp; A</b>	All
17:30 - 18:00	<b>LIGHT LUNCH AND POSTER SESSION</b>	



# Organising Committee



*Conference Chair*

**PROFESSOR LOUIS-ALBERT TCHUEM TCHUENTÉ**

NTD Ambassador

National Coordinator, National Program for the Control of Schistosomiasis  
Ministry of Public Health - Cameroon.



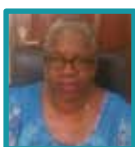
**PROF. ROGER MOYOU-SOMO**

*Institute of Medical Research and Study  
of Medicinal Plants  
Medical Research Centre, Yaoundé - Cameroon*



**DR ALAIN ETOUNDI MBALLA**

*Director, Disease Control, Epidemics  
and Pandemics  
Ministry of Public Health - Cameroon*



**PROF. ANNE-CÉCILE-ZOUNG K. BISSEK**

*Head of Operational Research in Health Division  
Ministry of Public Health - Cameroon*



**PROF. RUSSELL STOTHARD**

*Liverpool School of Tropical Medicine - UK*



**PROF. DAVID ROLLINSON**

*Natural History Museum - UK*



**DR JUTTA REINHARD-RUPP**

*Merck-Serono - Switzerland*



**DR LORENZO SAVIOLI**

*Global Schistosomiasis Alliance*



**DR MIKE HSEIH**

*National Institute of Health - USA*

The **TES Conference** recognises economic hardships for some, and was pleased to award a number of scholarships to selected national and international students and post-docs. The scholarship provided financial assistance to help Master & PhD students and junior researchers, who would otherwise not have been able to attend this unprecedented conference.

The scholarship was open to candidates from universities and research institutions at national and international level, working in areas related to schistosomiasis and soil-transmitted helminthiasis research.





## Session 1

### 01 SCHISTOSOMIASIS ELIMINATION: PROGRESS AND CHALLENGES

DAVID ROLLINSON<sup>(1)</sup>, STEFANIE KNOPP<sup>(1,2,3)</sup>, FATMA KABOLE<sup>(4)</sup>, SAID A. MOHAMMED<sup>(5)</sup>, BOBBIE PERSON<sup>(6)</sup>

1. Department of Life Sciences, Natural History Museum, London, United Kingdom
2. Department of Epidemiology and Public Health, Swiss Tropical and Public Health Institute, Basel, Switzerland
3. University of Basel, Basel, Switzerland
4. Neglected Tropical Disease Control Programme, Ministry of Health, Zanzibar, United Republic of Tanzania
5. Public Health Laboratory - Ivo de Carneri, Pemba, United Republic of Tanzania
6. Independent Consultant, Schistosomiasis Consortium for Operational Research and Evaluation, University of Georgia, Athens, United States of America

Many African countries are stepping up their efforts to control and in some cases eliminate schistosomiasis prompted by the targets set by the World Health Organization and the projected increase in the supply and availability of praziquantel. However, to achieve elimination is not a simple task, especially in rural communities that lack good sanitation and safe water supplies, and more effective, local and sustainable strategies are needed to reach the elimination goal. Better use of existing drugs, and combinations of different interventions, including water, sanitation and hygiene (WASH), snail control and behavioural change will need to be implemented. For example, in Zanzibar, following many years of morbidity control the Ministry of Health is focusing on the possibility of elimination of urogenital schistosomiasis. A research study is on going to determine the impact of interventions in addition to biannual chemotherapy, namely behavioural change and snail control. The study highlights the dynamic and focal nature of disease transmission and the need to concentrate efforts in places (hotspots) where prevalence persists. Many external factors can challenge control and elimination efforts including difficulties to achieve high treatment coverage and compliance, rapid reinfection, migration of people, zoonotic infections, and insensitive diagnostic methods. Robust and highly sensitive and specific diagnostic tools with high throughput potential will help to better define endemic areas and target interventions, monitor the impact of interventions and validate elimination. Elimination should be achievable in many ecological settings but will likely require increased efforts and resources. To be sustainable countries must make a long-term commitment to surveillance and have the ability to respond to disease outbreaks.

### 02 PROGRESS IN SCHISTOSOMIASIS AND SOIL-TRANSMITTED HELMINTHIASIS CONTROL IN CAMEROON

PNLSHI

(National Programme for the Control of Schistosomiasis and STH, Cameroon)

The national programme for the control of schistosomiasis and soil-transmitted helminthiasis in Cameroon was launched in 2004. Over years tremendous progress has been

made, and the number of school aged children treated has significantly increased from about 35,000 in 2006 to more than 2.5 million today. Key achievements, opportunities and challenges for the control of schistosomiasis in Cameroon will be presented.

### 03 IMPACT OF THE ANNUAL MASS DRUG ADMINISTRATION OF PRAZIQUANTEL ON SCHISTOSOMIASIS TRANSMISSION IN CAMEROON

CALVINE NOUMEDEM DONGMO<sup>(1,3)</sup>, HERMINE BOUKENG JATSA<sup>(2,3)</sup>, MÉRIMÉ CHRISTIAN KENFACK<sup>(2,3)</sup>, NESTOR GIPWE FEUSSOM<sup>(2,3)</sup>, LOUIS-ALBERT TCHUEM TCHUENTE<sup>(1,3,4)</sup>

1. Laboratory of Parasitology and Ecology, Faculty of Sciences, University of Yaoundé I, Yaoundé, Cameroon
2. Laboratory of Animal Physiology, Faculty of Sciences, University of Yaoundé I, Yaoundé, Cameroon
3. Centre for Schistosomiasis and Parasitology, Yaoundé, Cameroon
4. National Programme for the control of Schistosomiasis and Intestinal Helminthiasis, Ministry of Public Health, Yaoundé, Cameroon.

Schistosomiasis is widely distributed in Cameroon. The disease has a major health and socio-economic repercussions and constitutes an important public health problem. In order to reduce the burden of the disease, a national control program was launched in 2004. Mass drug administration (MDA) interventions were primarily school-based and praziquantel (PZQ) is distributed annually in moderate and high risk communities. The main objective was to assess the impact of repeated treatment with PZQ on the infection level of schistosomiasis in school-age children. Parasitological surveys were conducted between 2013 and 2014 in eight sentinel sites selected randomly from the baseline mapping surveys. This was done according to the baseline moderate or high prevalence in *Schistosoma mansoni*, *S. haematobium* and *S. guineensis*. At least 50 school children from 19 schools were randomly selected per site. Urine and fresh stool samples were examined in the field using urine filtration and Kato-Katz technique respectively. The results were compared with the baseline data.

Globally, 1192 school children were included to the study. The overall prevalence of *S. haematobium* was 15.5% (95% CI: 11.9 - 20%) and mean intensity was 4.13 eggs per 10mL of urine (95% CI: 1.8 - 6.4 eggs/10 mL) in 2013, representing 70.6% and 93% reduction from the baseline respectively. The overall prevalence of *S. mansoni* was 25.32% (95% CI: 21.2 - 29.4%) and mean intensity 111.6 epg (95% CI: 48.9 - 175.4 epg) in 2013, representing 33.2% and 51% reduction from the baseline respectively. The overall prevalence of *S. guineensis* was 13.13% (95% CI: 10.3 - 16.7%) and mean intensity 12.5 epg (95% CI: 7.3 - 17.7 epg) in 2014, representing 80.6% and 93.5% from the baseline respectively. Additionally, the proportion of moderate and heavy infection was 3.3%, 12.2% and 3.8% respectively for *S. haematobium*, *S. mansoni* and *S. guineensis*, a significant reduction from 21.2%, 22.1% and 36.4% at the baseline

respectively. In order to control and eliminate schistosomiasis in Cameroon, the national deworming program must maintain effective MDA coverage with PZQ and extend deworming to all communities at the endemic area.

## 04 **IMPACT OF THE SYSTEMATIC SCHOOL-BASED DEWORMING PROGRAM ON SCHISTOSOMIASIS ENDEMICITY LEVEL AND MORBIDITY IN THE SCHISTOSOMA MANSONI FOCUS OF YORRO, BAFIA HEALTH DISTRICT, CAMEROON**

**ROGER MOYOU-SOMO**

*Institute of Medical Research and Study of Medicinal Plants, Medical Research Centre, Yaoundé, Cameroon*

## 05 **PREVALENCE AND INTENSITY OF INFECTION WITH SCHISTOSOMA MANSONI INFECTION IN FOUR VILLAGES IN ADAMAOUA REGION OF CAMEROON AFTER REPEATED MASS TREATMENT WITH PRAZIQUANTEL.**

**ROMUALD ISAKA KAMWA NGASSAM<sup>(1)</sup>, MOHAMADOU ABDALA HIIM NYAGA OUMAROU<sup>(2)</sup>, SONG LIANG<sup>(3)</sup>, LOUIS-ALBERT TCHUEM TCHUENTÉ<sup>(4)</sup>**

1. Department of Biological Sciences, Faculty of Sciences, University of Maroua, Cameroon.

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Schistosomiasis is an important public health problem in Cameroon, with *Schistosoma haematobium* and *S. mansoni* as the most prevalent species. Since 2007, mass drug distribution campaigns have been ongoing in most of the affected areas of the country. Remarkable progress in reducing schistosomiasis infection has been reported in some places in the country. However, in Adamaoua region in the northern part of the country where *S. mansoni* is the most prevalent species. Despite repeated mass drug distribution, it remains unclear whether similar control results have been achieved. An evaluation of treatment effects is essential for the control in the region and this need to be based on sensitive diagnostic tools that can detect low infection level commonly reached after drug administration in endemic areas. The Kato-Katz test is the most common diagnostic method for *S. mansoni* infection in field studies. However, the test becomes less sensitive with decrease in infection. The urine-circulating antigen (CCA) cassette assays for *S. mansoni* have shown higher sensitivity in detecting *S. mansoni* infection than the Kato-Katz test especially in areas of low prevalence. Hence this study aims to evaluate the impact of repeated drug treatments on the prevalence of *S. mansoni* infection in four endemic villages (Mayo-baléo, Berem-Gop, Nom-kadi, Wouldé) in two health district of the Adamaoua region (Tignere and Ngaoundere rural). We also compare the diagnostic performance urine-circulating cathodic antigen

(CCA) cassette assays and the standard Kato-Katz for the detection of *S. mansoni* infection. The survey was conducted among school children randomly selected across four schools in the four villages and 199 recruited children provided the specimens. The overall prevalence: 15.08% (95%CI, 10.1-20.1%), varying from 2% to 34.69%, and overall infection intensity of 7.69EPG varying from 0 - 25.56EPG. These reflect significant reduction in comparison with both measures in 2006: overall prevalence of infection 48.72% (95% CI, 41.1 - 55.7%) varying from 30% - 64.10% and an overall EPG of 117.1 (95%CI, 78.84 - 155.5) varying from 68.16 to 162.43. all results were based on the Kato-Katz test. In comparing performance of CCA-Assay with Kato-Katz test, the sensitivity of the test varied from 72 to 90%, and specificity from 65 to 98%. The result of this study showed significant declines of prevalence and intensity of infection probably due to chemotherapy interventions. It also revealed that CCA may be a satisfactory diagnostic method for surveillance of *S. mansoni* infection in these villages.

## 06 **SCHISTOSOMIASIS AMONG SCHOOL AGE CHILDREN IN IPOGUN AREA OF ONDO STATE, NIGERIA: UPDATE ON PREVALENCE FOLLOWING SEVERAL YEARS OF ANNUAL TREATMENT**

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The study investigated the current status of both urinary and intestinal schistosomiasis among primary school aged children of Ipogun community in Ifedore Local Government Area, Ondo State, Nigeria given ongoing efforts which mainly involve annual distribution of praziquantel to these children, through the national schistosomiasis control program. The study sought to provide data for assessing the impact of intervention. School aged children in the community were screened for urinary and intestinal schistosomiasis infections using filtration technique and Kato- Katz method respectively. Of the 202 children screened, 117 (57.9%) were positive for microhaematuria, while 91 (45.0%) had ova of *Schistosoma haematobium* in their urine. Eggs of *Schistosoma mansoni* were however not detected in any of the stool samples collected. Prevalence by genders showed no statistical significance ( $P < 0.05$ ), although females were more infected than males. Given the global target of eliminating morbidity due to schistosomiasis by year 2020, concerted effort by the state government to interrupt transmission through provision of pipe-borne water or bore holes, mollusciciding and health education to promote individual and community hygiene should be put in place to augment the annual treatment strategy.



## 07 **EPIDEMIOLOGY OF URINARY SCHISTOSOMIASIS IN RURAL COMMUNITIES OF OVIA SOUTH WEST LOCAL GOVERNMENT AREA OF EDO STATE, NIGERIA**

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Urinary schistosomiasis is endemic in many rural communities of Nigeria where the people are impoverished, lack access to portable water and sanitary facilities. School age children are mostly affected in some Local Government Areas of the country where endemic foci may pose a challenge for the National Control Program efforts. A cross-sectional study was carried out to investigate the status of urinary schistosomiasis among 251 school aged children in Ovia South West Local Government Area of Edo State, Nigeria. Urine samples were examined using haemastix test and filtration technique. A questionnaire survey, was also conducted among children and health care providers that probed into knowledge, attitude and practices of on-going control activities. The results revealed prevalence of 34.0% and 64.0% for haemastix test and urine filtration respectively. The intensity of infection by egg count ranged from 1 – 5044 (mean = 449.8) eggs in 10ml of urine, with more children having heavy infections (76.8%,  $p < 0.005$ ) than light infections. The prevalence was higher in males (48.1%) than in the females (44.0%) but was not significantly different; children in the age group 10-14 and 15-19 years had the highest and lowest prevalence of infection respectively. Water contact was attested as a source of infection by 49.0% of the respondents, who claimed to carry out domestic and recreational activities in the water, out of which 60.1% were actually infected. The level of awareness of the disease amongst the children as revealed by questionnaire was very low. The knowledge of treatment programme and preventive measures was minimal amongst the children, despite on-going annual mass treatment with praziquantel. The high prevalence reported in these communities demands an integrated approach to control which will incorporate the provision of portable water and sanitary facilities.

## 08 **SCHISTOSOMA HAEMATOBIIUM INFECTION ASSOCIATED WITH PLASMODIUM FALCIPARUM INFECTION BURDEN IN SCHOOL AGED CHILDREN LIVING IN THE VICINITIES OF LAMBARÉNÉ, GABON.**

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The burden of malaria remains high in the sub-Saharan region notably in rural and semi-urban area where helminths are endemic. In this area, children are often infected with both *P.*

*falciparum* and helminth parasites. There is evidence of the effect of helminths on malaria infection. The impact of these helminths on malaria are not clearly elucidated yet and the scarce findings are conflicting. In this study we aim to investigate the effect of *S. haematobium* infection on the burden of *P. falciparum* malaria infection. Schistosomiasis aggravate the burden of plasmodium falciparum infection. This is a longitudinal study conducted in school aged children living in two rural vicinities of Lambaréné, Gabon. Participants have been allocated to one of the two study groups according to their schistosomiasis status. Thick blood smear was performed for the detection of *P. falciparum* parasites, urine filtration was performed for the detection of *S. haematobium* eggs. The KATO-KATZ technique was used for diagnostic of soil transmitted helminths. *P. falciparum* carriage was assessed at inclusion, and incidence of clinical malaria and time to the first clinical malaria event were recorded. At baseline, 739 participants were assessed. The overall prevalence was 30% for *S. haematobium* and 23% for *P. falciparum* infection. Prevalence of *P. falciparum* infection was higher in *Schistosoma* infected children (29% vs 19%,  $P$ -value=0.003) and at crude analysis, children infected with schistosomiasis had an odds ratio of 1.77 [1.23-2.53] of being infected with *P. falciparum* parasite compared to non-infected. We found that the effect of *S. haematobium* on *P. falciparum* infection is different depending on the presence or absence of *Trichuris* and/or Hookworm infection (Breslow-test,  $p = 0.046$ ). In children without *Trichuris* and hookworm infection, there is no association between *S. haematobium* and *P. falciparum* ( $aOR=1.05$  [0.65-1.67]) while *S. haematobium* was associated with *P. falciparum* in children infected with *Trichuris* and/or Hookworm ( $aOR=3.92$  [1.75-9.19]). A total of 584 children were followed for incidence and time to first clinical malaria. The overall incidence of clinical malaria was 0.51 [0.45-0.57] person-year. Clinical malaria incidence was higher in the *Schistosoma* infected group compared to the uninfected group (0.61 [0.55-0.67] vs 0.43 [0.38-0.48]). We found a significant delay to time-to-first clinical malaria in children aged from 6 to 10-year-old exposed to schistosomiasis compared to those not exposed. Our results suggest that STH interact with *Schistosoma haematobium* to increase *P. falciparum* parasite carriage and that exposure to *Schistosoma* infection enhances susceptibility to develop malaria infection in an age dependent manner.

## 09 **SCHISTOSOMA HAEMATOBIIUM GROUP; EPIDEMIOLOGY AND BIOLOGICAL COMPLEXITIES - IMPACT IN CONTROL**

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**10 DEVELOPING AN INTENSIFIED INTERVENTION FRAMEWORK AND APPROPRIATE ENVIRONMENTAL SURVEILLANCE FRAMEWORK TO GUIDE THE INTERRUPTION OF SCHISTOSOMIASIS TRANSMISSION**

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**11 MAY HYBRID SCHISTOSOMES IMPAIR SCHISTOSOMIASIS CONTROL?**

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Hybridization of parasites is an emerging public health concern and may be favoured by global changes. As human migration increase, people encounter new pathogens more frequently and co-infections with parasites of different strains or different species within the same individuals increase. Hybrid viability within the genus *Schistosoma* has long been evidenced by both laboratory-controlled cross experiments and direct field observations. Today, there is a renewed interest for hybrid schistosomes because field works have shown their high prevalence in humans in West African countries, and because an hybrid schistosome has recently emerged in the south of Europe (Corsica, France) infecting a hundred of people for the first time in this country. Hybridization makes the epidemiological situation of schistosomiasis much more complex by increasing the risk of (i) enhancing compatibility/virulence for both invertebrate and vertebrate hosts (i.e. hybrid vigor), (ii) widening the host spectrum and the possible resulting zoonotic transmissions, (iii) selecting for drug tolerant parasites and (iv) impairing the diagnosis efficiency and accuracy. We propose to discuss the possible consequences of hybridization in the schistosome control perspectives with a special focus on *S. haematobium* x *S. bovis* hybrids

**12 MOVING FROM CONTROL TO ELIMINATION OF SCHISTOSOMIASIS IN SUB-SAHARAN AFRICA: TIME TO CHANGE AND ADAPT STRATEGIES**

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Schistosomiasis is a water borne parasitic disease of global importance and with ongoing control the disease endemic landscape is changing. In sub-Saharan Africa, for example, the landscape is becoming ever more heterogeneous as there are several species of *Schistosoma* that respond in different ways to ongoing preventive chemotherapy and the inter-sectoral interventions currently applied. The major focus of preventive chemotherapy is delivery of praziquantel by mass drug administration to those shown to be, or presumed to be, at-risk of infection and disease. In some countries, regional progress may be uneven but in certain locations there are very real prospects to transition from control into interruption of transmission, and ultimately elimination. To manage this transition requires reconsideration of some of the currently deployed diagnostic tools used in surveillance and downward realignment of existing prevalence thresholds to trigger mass treatment. A key challenge will be maintaining and if possible, expanding the current donation of praziquantel to currently overlooked groups, then judging when appropriate to move from mass drug administration to selective treatment. In so doing, this will ensure the health system is adapted, primed and shown to be cost-effective to respond to these changing disease dynamics as we move forward to 2020 targets and beyond.



## Session 2

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### FEMALE-GENETAL SCHISTOSOMIASIS – A HOLISTIC APPROACH

HERMANN FELDMEIER

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### THE PAEDIATRIC PRAZIQUANTEL CONSORTIUM – HELPING CHILDREN WITH SCHISTOSOMIASIS

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### IN VITRO AND IN VIVO EFFICACY OF SIDA PILOSA RETZ AGAINST SCHISTOSOMA MANSONI-INDUCED PATHOLOGY

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*Schistosoma mansoni* is the major etiological agent of human schistosomiasis which is currently endemic in Africa, the Middle East, the Caribbean and South America. The excessive use of praziquantel has raised concerns about this drug developing resistance. *Sida pilosa* Retz (Malvaceae) is a plant traditionally used for the treatment of intestinal helminthiasis. In order to determine its potential use in the treatment of schistosomiasis mansoni, *S. pilosa* aqueous extract and derived fractions were investigated for their activity against *S. mansoni* adult worms; and in vivo, the schistosomicidal, antioxidant, anti-inflammatory and anti-fibrotic potentials of *S. pilosa* aqueous extract (SpAE) and the n-butanol fraction (SpBF) were evaluated.

For the in vitro experiment, adult worms obtained from infected mice and maintained in a GMEN culture medium, were exposed to different concentrations of the extract (1.25 - 40 mg/mL) and derived fractions (n-hexane, dichloromethane, ethyl acetate and n-butanol: 0.25 - 8 mg/mL) for 24h and analysed under an inverted microscope. For in vivo studies, mice were inoculated with cercariae and 6 weeks post-infection, SpAE (100, 200 and 400 mg/kg) or SpBF (50, 100 and 200 mg/kg) was administered orally for the following 4 weeks. Praziquantel (100 mg/kg for 5 days) was used as reference drug. Mice were euthanized at

10 weeks post-infection. Worm burden and egg laying were evaluated. Malondialdehyde (MDA), lipid hydroperoxides (LOOH), catalase (CAT), superoxide dismutase (SOD), eosinophil peroxidase (EPO) and myeloperoxidase (MPO) were measured. The level of hydroxyproline and  $\gamma$ -interferon (IFN- $\gamma$ ) were also evaluated. The number and the volume of granulomas were determined on hematoxylin-eosin sections of the liver and the intestine. In vitro studies demonstrated that *S. pilosa* aqueous extract and fractions significantly increased worm mortality, but reduced egg output in a concentration-dependent manner. The most active fraction was n-BuOH fraction with a LC50 of 1.25 mg/mL. HPLC-MS analysis of this fraction revealed the presence of two indoloquinoline alkaloids. The treatment of *S. mansoni*-infected mice with SpAE or SpBF at 200 mg/kg significantly reduced total worm count as praziquantel. Both SpAE and SpBF significantly reversed the lipoperoxidation induced by the infection and normalized the antioxidants activities (SOD and CAT). EPO and MPO activities considerably increased after infection ( $p < 0.001$ ), but SpAE succeed to reduce these activities in view of a normalization. *S. mansoni*-infection also resulted in an increase of hydroxyproline content ( $p < 0.001$ ) and a decrease in IFN- $\gamma$  level ( $p < 0.001$ ). Both SpAE and SpBF significantly reduced hepatic hydroxyproline content, while only SpAE improved IFN- $\gamma$  level ( $p < 0.05$ ). Moreover, a significant reduction of the number of granulomas in the liver (52.82%) or the intestine (52.79%), as well as a reduction of their volume in the liver (48.83%) were observed after treatment with SpAE. These results demonstrated that despite the fact that SpBF was the most active fraction against *S. mansoni* adult worms, in vivo, SpAE was more effective than SpBF in terms of schistosomicidal, antioxidant, anti-inflammatory and anti-fibrotic activities. These SpAE activities were comparable to those achieved by praziquantel.

### CHANGES IN SEMINAL HIV-1 RNA LOAD AFTER PRAZIQUANTEL TREATMENT OF UROGENITAL SCHISTOSOMIASIS IN HIV POSITIVE MEN – A PILOT STUDY

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Urogenital schistosomiasis due to *Schistosoma haematobium* infection is hypothesized to cause increased HIV-1 RNA shedding in semen in co-infected men as result of chronic egg-induced inflammatory lesions in the prostate and the seminal vesicles. Effect of treatment with the antihelminthic agent praziquantel on HIV-1 RNA load was assessed in this pilot study.

Eighteen HIV-positive men co-infected with *S. haematobium* eggs detected by urine filtration technique were enrolled into the study in accordance to antiretroviral therapy (ART): 6 ART-naïve and 12 ART-experienced. HIV-1 RNA load was determined in blood plasma and semen prior to praziquantel treatment at baseline and at 10 weeks post-treatment follow-up. All participants became egg-negative in urine at follow-up. Among the ART-naïve participants, mean HIV-1 RNA load decreased by 0.32 log<sub>10</sub> copies per mL (4.41 versus 4.09;  $p = 0.079$ ) in blood plasma from baseline to follow-up, and in semen by 1.06 log<sub>10</sub> copies per mL (4.06 versus 3.00;  $p = 0.076$ ). A similar trend in viral decrease was observed among the ART-experienced participants. This pilot study suggests that praziquantel treatment of HIV positive men co-infected with urogenital schistosomiasis may reduce HIV-1 RNA shedding in semen. A larger randomized controlled trial is warranted to explore further into observation.

## 17 IMPROVING SURVEILLANCE OF FEMALE GENITAL SCHISTOSOMIASIS (FGS): VALIDATING HOME-BASED CERVICAL AND VAGINAL SELF-SAMPLING FOR DETECTION OF FGS IN ZAMBIAN WOMEN WITH AND WITHOUT HIV SEROCONVERSION.

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Female genital schistosomiasis (FGS) affects over 45 million women worldwide and in sub-Saharan Africa it is possibly the most underestimated gynecological affliction caused by an infectious agent, the waterborne parasite *S. haematobium* (Sh). FGS is associated with genital symptoms and infertility with compelling evidence of increased HIV prevalence in Sh infected women. FGS Diagnosis is extremely challenging, as it relies on expensive equipment that is seldom available in resource limited areas. To test the performance and acceptability of home-based genital self-sampling procedures for the detection of Sh DNA, and to validate novel molecular diagnostic assays to diagnose Female Genital Schistosomiasis (FGS) in Zambian women, with and without HIV seroconversion. The project will also explore novel biomarkers of inflammation from vaginal fluid as potential markers of disease severity and a novel Point-of-Care (POC) colposcope. 1,000 women aged 18-25 HIV negative at baseline will be recruited from the HIV incidence trial (PopART) study in Zambia, after last follow up at 36 months in Livingstone and Choma in August 2017. Areas endemic for Sh (30-70%). Two community workers will perform home visits they will be asked women to fill a gynaecological symptoms and acceptability questionnaires and to provide a 10 ml urine sample. A small cotton swab and a cervical brush will be given to them for self-collection of a vaginal and cervical

swab. Participating women will be asked to attend the local health centre where a trained nurse will perform a vaginal lavage as the gold standard sampling procedure. Cervical images will be obtained with a POC colposcope and remotely reviewed. Samples collected in the homes will be processed at ZAMBART Institute in Lusaka. Parasitological diagnosis will be made by urine filtration for Sh eggs, urine CAA antigen assay, real-time qPCR and Recombinase Polymerase Assay (RPA) from urine, cervical and vaginal swab samples. All women testing positive for *S. haematobium* by any method, will be offered link into gynaecological care at Southern Province Hospital in Livingstone with colposcopy facilities as well as given treatment with praziquantel. This study would provide a unique opportunity to nest an innovative diagnostic study for FGS within the largest HIV incidence trial ever designed. Home-based diagnosis of FGS is an avant-garde concept, yet not unrealistic, for this neglected disease. This is a first attempt at implementing self-sampling strategies for the diagnosis of FGS and by doing so increase the surveillance of a neglected gynaecological morbidity with clear negative implications for women's sexual and reproductive life. It will also explore markers of disease severity with potential clinical prognostic value. Moreover, results of this study will strengthen the knowledge of the association between FGS and HIV and provide incidence data for the first time. A new diagnostic algorithm could be developed and include home-based self-sampling procedures coupled with POC molecular diagnostics to be tested in larger FGS intervention trials. This study is therefore of immense public health importance and in particular for the reproductive life of young women.

## 18 EPIDEMIOLOGICAL AND ULTRASONIC PROFILE OF URO-GENITAL SCHISTOSOMIASIS IN BAROMBI KOTTO

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## Session 3

### 19 **CAA AND CCA DETECTION IN SCHISTOSOMIASIS: ASSURED DIAGNOSTIC TOOLS TO BE EMPLOYED WHEN MOVING FROM CONTROL TO ELIMINATION**

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The renewed interest in mapping, intensified control and elimination of schistosomiasis (World Health Assembly Resolution WHA 65.21) has put the need for highly accurate diagnostic assays high on the agenda. Based on the well-studied schistosome antigen detection (CCA and CAA) ELISA's, a visual, field-friendly point-of-care urine test for CCA and a quantitative, ultra-sensitive reader-assisted assay for CAA have been developed. The CCA test is commercially available and may replace the Kato-Katz for prevalence mapping of community-level *S. mansoni* infections using a single drop of urine and also allows quick evaluation within days of treatment efficacy. The recently developed test for CAA is applicable to serum or urine of all schistosome species at sub-pg levels, which allows finding single worm infections. The assay has been transformed into a robust, dry-reagent test, used in several low-resource settings in Africa. In combination with optimized sampling schedules the CAA could rapidly identify foci of low prevalence/intensity of all human schistosome infections. Recent studies using the 2 ml urine format show that in near-elimination settings in China, South-East Asia, Africa and Brazil, prevalence of active schistosome infections by egg microscopy may be underestimated up to 10-fold. Also, decrease of CAA serum and urine levels after treatment has been shown in all effectively treated cases, however complete cure rates are very limited. The CAA strip assay therefore presents itself as a highly accurate diagnostic tool, with a clear value for application in control and elimination settings.

### 20 **DEVELOPMENT OF AN INTERLEUKIN-4-INDUCING PRINCIPLE FROM SCHISTOSOMA MANSONI EGGS (IPSE)-SPECIFIC PCR ASSAY AS A QUANTITATIVE PREDICTOR OF SCHISTOSOMIASIS-ASSOCIATED MORBIDITY**

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Schistosomiasis is a neglected tropical disease (NTD) affecting between 200-500 million people worldwide. The two species causing most human cases of schistosomiasis are *Schistosoma mansoni* and *Schistosoma haematobium*. The gold standard for diagnosis is parasitological detection of parasite eggs in

stool using the Kato-Katz method. Counting eggs passed in stool is labor-intensive with poor sensitivity. Interleukin-4-inducing principle from *Schistosoma mansoni* eggs (IPSE) is the most abundant secreted protein from schistosome eggs. We hypothesized that the mRNA transcripts of the IPSE protein may be found in the stool, urine, body fluids and other host tissues, and that these transcripts can be specifically targeted as a quantitative molecular diagnostic tool for schistosomiasis in endemic areas. Liver tissue and stool samples were collected from *S. mansoni* and *S. haematobium* infected mice and hamsters, respectively. A standard curve was generated by qPCR amplification of IPSE mRNA from known concentrations of parasite egg RNA. The resultant proportional equation was applied to assess correlation between concentration of parasite RNA in samples with egg counts by microscopy. Preliminary results showed a positive correlation between increasing concentrations of IPSE RNA in infected liver tissue and the number of eggs counted in stool. Our next steps are to optimize this assay using *Schistosoma haematobium* infected hamsters, and to potentially develop this assay as an accurate estimation of morbidity in field settings.

### 21 **EVALUATION OF CIRCULATING CATHODIC ANTIGEN (CCA) URINE-TESTS FOR THE DIAGNOSIS OF SCHISTOSOMA GUINEENSIS INFECTION IN CAMEROON**

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Bilharzia is a disease caused by many species of schistosomes which diagnosis in endemic area is commonly done by the Kato-Katz method. However, this test under-estimates the prevalence especially in low endemicity area. The efficacy of circulating cathodic antigen (CCA) urine-assay have been reported for the detection of *Schistosoma mansoni*, *S. japonicum* and *S. mekongii*. However, no study was conducted for *S. guineensis* so far. In our study, we evaluate the accuracy of CCA as a diagnostic tool for *S. guineensis*. Our study was conducted in three localities where *S. guineensis* occurs in Cameroon, i.e. Edea in the Littoral Region, Eseké in the Centre Region, and Ekondo-titi in the South-West Region. In total, stool and urine samples were collected from 479 children. The urine samples were tested using the CCA, one cassette test per each sample. For each stool sample, three Kato-Katz slides were prepared and read for the presence of schistosome and other helminth eggs. Considering triple Kato-Katz as the "gold standard", the prevalence of *S. guineensis* was 6.32%, 5.68% and 19.26% in Edea, Eseké and Ekondo-Titi, respectively. The

# Abstracts

prevalence of CCA was 30.52%, 35.22% and 37.87% in Edéa, Eséka and Ekondo-Titi, respectively. The sensitivity of CCA, from the overall data analysis of the three settings, varied between 89.31% and 97.12%. The specificity ranged between 67.55% and 100%. When the combined results was considered as "reference" test, the CCA sensitivity was 100% in Edéa, 96.88% in Eséka and 94.12% in Ekondo-titi. The sensitivity of the triple Kato-Katz was 20.68% in Edéa, 16.22% in Eséka and 47.9% in Ekondo-Titi. Although, the CCA assay appeared as an attractive method for the diagnosis of *S. guineensis*, the AUC results (less than 70%) revealed that the CCA may not be a good assay to be used for the diagnosis of *S. guineensis*.

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## **AN M&E FRAMEWORK FOR SCHISTOSOMIASIS**

FIONA FLEMING

*Schistosomiasis Control Initiative (London, United Kingdom)*

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## **PRECISION MAPPING: AN INNOVATIVE TOOL AND NEW WAY FORWARD TO ENHANCE THE ELIMINATION OF SCHISTOSOMIASIS IN CAMEROON**

CSP/PNLSHI

*Centre for Schistosomiasis and Parasitology, Yaoundé Cameroon*

*National Programme for the Control of Schistosomiasis and STH*



## Session 4

### 24 EXPERIENCE OF CHINA IN NATIONAL SCHISTOSOMIASIS ELIMINATION PROGRAMME. UPDATING JIANGXI-CAMEROON COOPERATION FOR SCHISTOSOMIASIS ELIMINATION

JANGXI PROVINCE TEAM

*Jiangxi Provincial Institute of Parasitic Diseases, China*

### 25 SNAIL CONTROL AND SCHISTOSOMIASIS ELIMINATION

JIA TIEWU

*WHO/AFRO*

### 26 GENOMIC TOOLS TO SUPPORT SCHISTOSOMIASIS RESEARCH

NIEL YOUNG

*The University of Melbourne, Australia*

### 27 Community Engagement is Essential for Behavioral Change and Control of Schistosomiasis

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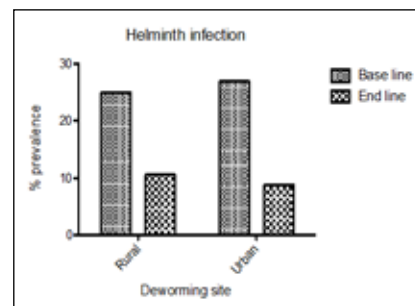
It is now over six years since we initiated a comprehensive deworming project for school children in Ethiopia that is based on a combination of health education and mass drug administration. The results of this long term program in the town of Mekele, were evaluated continuously from 2009 to 2014, and have demonstrated clearly its efficacy in the sustained control of soil transmitted helminthes and schistosomiasis. Based on this experience, we have embarked on a similar program in the town of Adwa that addressed also the water and sanitation issues in that town.

We have applied our comprehensive community oriented program that combines intensive health education and behavioral change with mass drug administration and WASH, and is strongly based on community recruitment, community volunteers and community involvement, engaging both local health and education professionals, and using locally designed solutions and initiatives. The local education authorities monitored the participation of the schools in the program. Local parents organizations (PTA) took part in the health education campaigns and the construction and maintenance of the WASH facilities. Various community organizations- school headmasters and teachers, PTA, Womens' Volunteer Army, social workers and community workers joined the project.

The results of stool surveys carried out before and after the

intervention showed a significant decrease in the prevalence of helminthic infection from an overall mean of 26% to 9.7%, (see figure), and similarly, the results of Knowledge, Attitude and Practice questionnaires showed a significant positive change in the results at one year after the intervention.

We have demonstrated that the combination of intensive health education with MDA and WASH in school children can be highly effective and leads to sustained control of both SCH and STH. Though continuous follow up should evaluate how these results are further sustained, it most probably indicates that behavioral change of school children is essential for obtaining long lasting control of these infections. We propose that this model of intervention be adopted throughout Ethiopia as well as in other developing countries



### 28 BIOMPHALARIA CAMERUNENSIS CAMERUNENSIS (GASTROPODA: PLANORBIDAE) AS AN ALTERNATIVE HOST OF SCHISTOSOMA MANSONI IN THE SOUTHERN CAMEROON

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Intestinal schistosomiasis due to *Schistosoma mansoni* have been mapped in Cameroon in 1990 and preventive chemotherapy launched since 2005. A situation analysis conducted in 2011 revealed an increase in schistosomiasis transmission, especially in the equatorial part of the country, despite the fact that *Biomphalaria pfeifferi*, the main intermediate host of this parasite, is now scarce in many foci. *Biomphalaria camerunensis camerunensis*, restricted to the southern part of the country, is considered as a less suitable host for *S. mansoni* (as compared to its *B. pfeifferi* counterparts) due to its resistance to the parasite, although exhibiting a better survival. Given that susceptibility to *S. mansoni* is easier to achieve than resistance through generations, and that a rise in temperature might increase snail susceptibility, could *Biomphalaria camerunensis camerunensis* being associated with the persistence of the disease in Cameroon? In context where human's migrations are quite frequent as a consequence of terrorism, war torn in neighboring countries as well as development of hydraulic projects, it appears interesting to evaluate the current epidemiological role of *Biomphalaria camerunensis camerunensis* to estimate the risk of extension of *S. mansoni* in Cameroon. The susceptibility of three *B. pfeifferi* and five *B. camerunensis* populations to a strain of *S. mansoni*

was estimated. Collected snails were identified using both shell morphology and the PCR-based polymorphism of ITS2 region. Juvenile snails (G1) of each population where infested with five miracidia. Between the 20th and the 60th day after infestation, prepatent period, infestation success rate and survival rate of snails were recorded. Cercariae production during five days was also evaluated. Compatibility tests were performed on a total of 827 snails of which 344 *B. pfeifferi* and 483 *B. camerunensis*. Values of infestation success rate were quite heterogeneous ( $P < 0.01$ ). This value was higher in *B. pfeifferi* (61.5%) as compared to *B. camerunensis* (7.8%) (Chi-Square = 258.88;  $P < 0.0001$ ). All the three *B. pfeifferi* infested populations were susceptible *S. mansoni*. However, among the five *B. camerunensis* populations tested, four were susceptible to *S. mansoni*, three showing a success rate around 5.0% and the last one displaying a relatively high success rate (21.9%). The prepatent period ranged from 21 to 40, and from 34 to 40 days for *B. pfeifferi* and *B. camerunensis*, respectively ( $P < 0.0001$ ). Cercariae production was significantly higher in *B. camerunensis* as compared to *B. pfeifferi* ( $P < 0.001$ ). These findings indicate that *B. camerunensis* might substantially contribute to *S. mansoni* transmission and dissemination in Cameroon. Test and treatment of migrants in places where *S. mansoni* intermediate host are present are suitable and more attention and surveillance towards *B. camerunensis* appears highly needed if one wants to achieve intestinal schistosomiasis elimination in Cameroon.

## 29 **DETECTION OF HYBRIDE SCHISTOSOMA HAEMATOBIIUM GROUP SPECIES IN CAMEROON BY PCR-RFLP OF THE SECOND INTERNAL TRANSCRIBED SPACER ITS-2**

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Among the species of schistosomes infecting humans, *Schistosoma haematobium* is responsible for the largest number of infections in sub-Saharan Africa with an estimated 112 million people infected with this species. *Schistosoma haematobium* has been shown to be able to interbreed with its closely related sister species, resulting in hybridisation affecting the epidemiology of these parasites. *Schistosoma haematobium*, *Schistosoma mansoni*, *Schistosoma guineensis* and *Schistosoma bovis* have all been reported in Cameroon. In this study, *S. haematobium* samples from 8 villages in Cameroon were molecularly analysed to identify hybrid schistosomes. PCR-RFLP analyses of the second internal transcribed spacer (ITS-2) of ribosomal DNA (rDNA) were carried out on schistosomes worms which had been isolated from 8 villages; Bessoum, Ouro- Doukoudje, Djalingo-Kapsiki, Gounougou, Njombe, Penja, Loum and Mbafam. An ITS-2 DNA fragment of 501 bp was amplified from all the isolates of *S. haematobium* group and analysed. The TaqI enzymatic digestion of the ITS-2 DNA fragment revealed 3 different

band profiles: Profile A (typical of *S. haematobium*) which constituted of 2 bands (158 bp and 199 bp); Profile B (typical of *S. bovis* and *S. guineensis*) which constituted of 2 bands (199 bp and 230 bp); and Profile C (probably an intermediate form) which contained all 3 bands (158bp, 199bp and 230bp). One isolate from naturally infected snail (*Bulinus globosus*) collected from the rice field in Bessoum shown profile C. Tree worms from isolates collected from Mbafam and Djalingo-Kapsiki presented profile B, characteristic of probable hybrids. All other isolates presented with profile A, corresponding to the naturally occurring *Schistosoma haematobium* species. Our data provides an indication of hybrid *S. haematobium* group occurring in Cameroon and could serve as a reminder to inform control programs. Such findings highlight the constant need for the continued monitoring of the geographic spread and emergence of such hybrid forms.

## 30 **CHALLENGES ASSOCIATED WITH THE USE OF PRAZIQUANTEL FOR ERADICATION OF SCHISTOSOMIASIS IN NIGERIA: THE URGENT NEED FOR VACCINE DEVELOPMENT**

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Over 20 years now, Praziquantel, the drug of choice for schistosomiasis has been in use. Although the use of Praziquantel for the eradication of schistosomiasis looks promising, there are series of challenges recently encountered that may hinder the optimum goal for the mass production and distribution of the drug by MERCK and WHO. A base line study was conducted in the Kainji Dam lake areas of Nigeria in 2014 to ascertain the level and intensity of Urinary Schistosomiasis infection. Urine samples were collected from 784 primary school pupils, immediately fixed with formalin, stored, processed and subsequently examined using dissecting microscope and the intensity of the eggs determined using Talley counter. Praziquantel was then acquired and administered to the entire age bracket of the study population in the communities. Two follow-ups were conducted, one and two years after drug (Praziquantel) administration each year with 600 pupils. Ecological surveys were conducted and snail intermediate hosts were physically observed in and around the communities. Out of the 784 urine samples examined during the baseline study, 642 (81.9%) had ova of schistosomiasis with intensity ranging from 178 to 7,432 eggs in a 10mls urine. The follow-up in 2015 of 600 pupils a year after drug administration showed a reduction in the Schistosomiasis infection by 30.2%, and also in the intensity ranging from 82-3,421. However, in November, 2016, two years preceding the administration of Praziquantel, another follow-up study among 600 pupils revealed a resurgence of a higher prevalence of schistosomiasis (83.2%) and egg intensity ranging from 123-7,654 eggs in



a 10mils urine. The ecological survey revealed favourable vegetations for the breeding of the snail intermediate host and increased water contacts through Agricultural activities. Schistosomiasis resurfaced with higher prevalence years after drug administration among the infected pupils in the communities. The snail population in the environment remains a factor that possibility aided transmission and the lack of every community member having access to the drug coupled with lack of immunity for re-infection among those that had taken the drugs might have compounded the situation that gave rise to the recent higher prevalence. Therefore, mass community mobilization and health education about the transmission of Schistosomiasis must be mounted before, during and after

Praziquantel administration. Ultimately, if schistosomiasis, a public health problem second only to malaria among African countries is to be eradicated, vaccine development to compliment the existing drug of choice (Praziquantel) and to confront Schistosomiasis headlong must be a priority now. Funds should be made available for innovative research on snail intermediate hosts which also show promise for another possible intervention strategy.

## 31 SCHISTOSOMIASIS ELIMINATION: PHASE APPROACH AND RESEARCH PRIORITIES

## Poster Session

### 32 AN EVALUATION OF THE FORMS OF DISSEMINATION OF INTESTINAL HELMINTHS IN THE MFOUNDI MAINSTREAM (YAOUNDE): ROLE OF PHYSICO-CHEMICAL VARIABLES

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Schistosomiasis is a chronic disease that is caused by parasitical worms. Victims are infected through agricultural, domestic, professional or recreatives activities including exposition to contaminated water. Poor hygiene and some habits such as swimming in infected waters make these children particularly vulnerable to infection. It's in this mind that a study was carried out from January to June 2016 in order to identify the eggs of the different kinds of schistosomes in the Mfoundi waters, main waterway of the city of Yaoundé. Monthly samplings were carried out at four points of the waterway in the Bastos, central post, Mvog-Atangana-Mballa and Nsam. Physical and chemical analyzes were carried out both in the field and in the laboratory. Physical and chemical parameters were determined in the laboratory using appropriate methods and apparatus. The observation of Schistosoma eggs was carried out using the Olympus CK2 inverted microscope at 40X objective after concentration of the samples according to the formalin-ether and Kato-Kartz concentration techniques. The parasitological results have revealed the presence of 350 Schistosoma eggs belonging to three species: either 180 eggs for *Schistosoma haematobium*, 103 for *Schistosoma mansoni*, and 67 for *Schistosoma intercalatum*. The sizes varied between 120 and 240  $\mu\text{m}$ . In general, the highest average densities of Schistosomes in the Mfoundi waterway were recorded during the small raining season ( $215 \pm 61.62$  eggs / L) compared to those recorded during the big raining season ( $135 \pm 18.68$  eggs / L). The eggs of *S. haematobium* were most abundant throughout the study period and the station located in the Nsam area did not sheltered any organisms due to the recalibration work carried out at that point. Statistical analyzes were realized using SPSS software version 20.0 and Microsoft

Excel program. These analyzes showed significant correlations between the density of Schistosoma eggs and physical and chemical parameters such as temperature, TDS, conductivity, dissolved oxygen, alkalinity, ammoniacal nitrogen, dissolved CO<sub>2</sub>, oxidizability and orthophosphates. The Mfoundi waters and its tributaries undergo an anthropic action and receive wastewater from the markets, Cameroon companies. These waters are heavily laden with Schistosomes' eggs, so local residents and public authorities must therefore take targeted actions on environmental restoration and treatment of domestic effluents in order to reduce the parasitic load and the health risk bind to any use of Populations.

### 33 BIODYNAMICS OF SCHISTOSOMA EGGS IN THE MARSHY AREAS OF YAOUNDE (CAMEROUN): HIERARCHICAL IMPLICATIONS OF SOME ENVIRONMENTAL FACTORS

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Schistosomiasis constitute a real public health problem in Cameroon and affects a large part of the population causing chronic infections. *Schistosoma* spend part of their cycle in the environment before re-infecting humans contaminated food and water. Most analytical procedures for the isolation, identification and evaluation of the various environmental forms (egg, miracidium, furcocercaria) of schistosomiasis are highly limited to streams and lakes. Little studies have been carried out on the marshy areas which is a reservoir for biodegradable organic matter. It is with a view to investigate on the primordial role of marshy areas in the transmission of schistosomiasis that a study was carried out from January to June 2016 in order to characterize the various forms of resistance of *Schistosoma* present in this ecosystem in Yaoundé. Monthly water sampling for physical, chemical and biological analyzes was carried out on eight marshy areas: Obili, Melen, Etoug-ébé, Vog-betsi, Mokolo-élobie, Tsinga, Ekounou and Damas.

The observation of *Schistosoma* eggs was carried out using the Olympus CK2 inverted microscope at 40X objective after concentration of the samples according to the formalin-ether and Kato-Katz concentration techniques.

Biological analysis revealed the presence of eggs belonging to *Schistosoma* genus and that the size varies from 120 to 240 µm in all sampling stations and at different densities. 37 ± 36 eggs / L were identified at Obili ; 14 ± 13 eggs / L at Melen ; 37 ± 36 eggs / L at Mvog-betsi; 8 ± 10 eggs / L at Etoug-ébé ; 22 ± 30 eggs / L at Mokolo-élobie ; 22 ± 35 eggs / L at Tsinga ; 8 ± 170 eggs / L at Ekounou and 6 ± 12 eggs / L at Damas. In the small raining season 191 ± 174 eggs / L were counted against 77 ± 69 eggs / L in long dry season. The high density obtained during rainy season could be explained by the high rainfall observed during this season that would have collected fecal matters and transmitted them to the marshy areas assessed. Positive and significant correlations were recorded between *Schistosoma* eggs densities and some physical and chemical parameters such as oxidability, suspended solids, turbidity, total dissolved solids, nitrogen, ammonia and orthophosphate. The results obtained show that the marshy areas studied present a high density of *Schistosoma* eggs and that their dissemination is highly linked to the environmental factors. We therefore propose that the marshy areas should be given high priority in any initiatives for the elimination of schistosomiasis in our country.

## 34 **INTERRUPTING SCHISTOSOMIASIS TRANSMISSION IN CAMEROON: CONSIDERATIONS FOR MOVING BEYOND MDA TO 'SELECTIVE INTENSIFIED CONTROL'**

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3. Liverpool School of Tropical Medicine, Liverpool, United Kingdom

Cameroon has the political motivation to push for elimination of schistosomiasis; this is a national priority. As a step towards elimination, the World Health Assembly resolution WHA65.21 has called for the World Health Organization (WHO) to establish procedures to confirm the interruption of transmission of schistosomiasis. This "interruption of transmission" concept is now a global priority that has galvanised policy makers, program managers and researchers alike to investigate what, exactly, is required to make cessation of this debilitating disease a reality. The focality of schistosomiasis means this is likely to be achieved initially at site-specific levels. The concept of interrupting schistosomiasis transmission can be incorporated into a broader environmental framework, tailored to the features of the affected communities. For example, as prevalence declines, focus may need to shift from mass drug administration to intensified control strategies, considering

intermediate host, alternative treatment strategies, and both the aquatic and terrestrial environments. Data collected in June 2016 from Cameroon will be presented that demonstrate human and snail transmission dynamics in each of a moderate (>40%) and a low-prevalence (<10%) locality. Georeferenced maps will be used to highlight fine-scale heterogeneities between human water contact and snail hosts that need to be considered in intensified control strategies. Additionally, data will demonstrate the change in these sites over 10 years of mass drug administration, and the associated changes to age-prevalence profiles. The considerations for alternative, intensified treatment strategies to respond to these changes will be discussed. Options for practical education on human water contact behaviours, and snail control, will additionally be presented as targeted low-cost strategies that, combined, may interrupt transmission in these sites.

## 35 **URINARY SCHISTOSOMIASIS IN OGUTA LOCAL GOVERNMENT AREA: A RIVERINE AREA OF IMO STATE, SOUTH-EASTERN NIGERIA**

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Over the years, the prevalence of urinary schistosomiasis has been established across several locations in Nigeria. However, the need for continual validation of prevalence data at different ecological zones of the country remains imperative, especially in the face of incessant anthropogenic activities and climate change events such as deforestation and flooding. This study was therefore carried out to determine the current prevalence of urinary schistosomiasis at Oguta Local Government Area (LGA), a riverine location in Imo state, southeastern Nigeria between May 2007 and August 2008. Of the 1648 persons who were selected randomly and had their urine examined for *Schistosoma haematobium*, 642(38.90%) were positive. Highest prevalence rates were recorded at Oguta (58.80%), Egbugoma (49.80%), Egwe (45.80%), Orsu-Obodo (36.90%), and Ezi-Orsu (35.80%) which are communities in close proximity to Oguta Lake. Nkwesi and Abiazim communities located upland along the Njaba River that empties into Oguta Lake recorded the lowest prevalence rates (16.90 and 19.60% respectively). The infection varied significantly across various age and occupational groups ( $p < 0.05$ ), with prevalence rates being highest 43.10 - 46.90% among the 1 - 10 and 11 - 20 years age groups respectively and 32.50 - 37.60% among the 21 - 60 years age groups. However, more males (44.60%) than females (38.90%) were affected, while expectedly, farmers had a higher disease prevalence (69.00%) than other occupational groups. Among the infected persons, visible haematuria (50.00%) was the most common symptom recognized by the respondents, while supra pubic pain and painful micturition were scored lowly (16.26 and 16.70% respectively). It was concluded that



Oguta LGA is endemic for urinary schistosomiasis and is therefore recommended as a target location for disease control and public health intervention measures such as provision of improved waste disposal systems, alternative domestic water sources and mass anti-schistosomiasis drug distribution.

## 36 PREVALENCE AND INCIDENCE OF SCHISTOSOME INFECTION AND MORBIDITY IN PRE-SCHOOL CHILDREN AGED 6 MONTHS TO 5 YEARS.

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For a long time, infants and pre-school aged children (PSAC) have been considered low-risk for schistosomiasis, have received lower research focus and have been excluded from mass drug administration. Aim: Here, we describe the prevalence of schistosome infection and morbidity in children aged 6 months -5 years, as well as the incidence of first schistosome infection and morbidity in this age group. This is part of a larger longitudinal study of schistosome infections in children aged 6 months -5 years, in selected villages in Zimbabwe. A total of 1502 children were recruited in February 2016. Basic demographic and anthropometric measurements including weight, height and Mean Upper Arm Circumference (MUAC) was gathered. Stool and urine samples were taken from each child (in triplicates) for parasitological diagnosis of *S. haematobium* (urine-filtration) and to rule out *S. mansoni* or other Soil-transmitted Helminths (Kato-Katz). Markers of morbidity including visible and microhaematuria and Faecal Occult Blood (FOB) were assessed using reagent dipsticks and rapid tests. Based on anthropometry, 14.5% of all children were stunted, 8.0% malnourished and 9.7% of them were underweight. Prevalence of *S. haematobium* infection was 8.5% and that of *S. mansoni* was very low (0.2%). Prevalence of both *Schistosoma haematobium* did not differ across age and sex and anthropometry did not differ with infection status ( $p>0.05$ ). At baseline, FOB was positive in 2.3%, visible haematuria in 0.7% and microhaematuria in 8.6% of children. There was a positive association between visible haematuria (AFI:70.6%; AFP:40%), microhaematuria (AFI:92.1%; AFP:40%) and stunting (AFI:28.6%; AFP:1.2%) with *S. haematobium* infection as detected by parasitology ( $PR>1$ ). Mean incidence of *S. haematobium* infection was 5.1% with a mean 0.8% and associated 6.5% associated visible and microhaematuria respectively. We have demonstrated for the first time, the incidence of schistosome infections and associated morbidity in pre-school children. They are affected by schistosome infections and this is associated with significant morbidity. Available tools for schistosome diagnosis and morbidity assessment are applicable in this age group. The need for increased awareness, monitoring and treatment in this cohort is essential.

## 37 SCHISTOSOMICIDAL ACTIVITY OF THE AQUEOUS EXTRACT OF CLERODENDRUM UMBELLATUM POIR LEAVES AND ITS METHANOLIC FRACTION ON SCHISTOSOMA MANSONI INFECTED MICE

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Schistosomiasis is a chronic and debilitating disease affecting more than 200 million people in tropics and subtropics. The intensive use of Praziquantel for the treatment of schistosomiasis has raised concerns about the possible emergence of drug-resistant schistosomes. Since drug administration is an important feature of schistosome control programs, the search for alternative drugs is therefore a priority. The aim of this study was to assess the schistosomicidal activity of both the aqueous extract (AE) of *Clerodendrum umbellatum* Poir leaves and its methanolic fraction (MFAE). A phytochemical screening of AE and MFAE was performed. AE (at the doses of 80, 160, 320 mg/kg) and MFAE (at the doses of 100, 200 and 400 mg/kg) were administered orally and daily to *Schistosoma mansoni* infected mice (BALB/c). Administration started the 36th day post-infection and lasted 28 days. Praziquantel (PZQ) (500 mg/kg) served as reference drug. Non-infected and infected-untreated mice served as controls. All mice were sacrificed at the 65th day post-infection. Worm burden, fecal egg count, liver egg count, liver and spleen relative weights were determined. Phytochemical analysis of the AE revealed the presence of alkaloids, triterpenes, saponins, saponosides, tannins, flavonoids, phenols, cardiac glycosides and lipids. Concerning the fraction, we founded alkaloids, flavonoids, cardiac glycosides, phenols, saponins, tannins and terpenoids. Globally, the treatments with AE and MFAE reduced the impact of the disease on treated animals compared to the infected-untreated ones. Concerning the worm burden, the best percentage of reduction was recorded in group AE 160 (100%) and was similar to the PZQ group. The fecal egg load was also reduced after the treatments, with the best result noted in the group MFAE 400 (96.34%) which was closer to the result of PZQ group (100%). The highest reduction in hepatic egg load was recorded in the group AE 160 (97.21%) while in PZQ group it was 99.36%. Concerning liver and spleen weights, the highest reductions were recorded respectively at the doses of AE 160 (44.47%) and AE 80 (65.05%); showing that the treatments reduced the hepatosplenomegaly induced by *S. mansoni* infection. From the results, we can conclude that the aqueous extract of *C. umbellatum* as well as its methanolic fraction possessed an evident schistosomicidal activity and can be used as sources of potential drug against *Schistosoma mansoni*. However, the aqueous extract seems to be more effective than its methanolic fraction.

## 38 **VERY LOW PREVALENCE OF SCHISTOSOMIASIS AND SOIL-TRANSMITTED HELMINTHIASIS IN MBAM AND INOUBOU SUBDIVISION IN CENTRE REGION OF CAMEROON UNDER IMPLEMENTATION OF MASS DRUG ADMINISTRATION OF PRAZIQUANTEL AND MEBENDAZOLE**

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Previous studies revealed very high prevalence of Intestinal schistosomiasis and soil-transmitted helminthiasis in Mbam and Inoubou subdivision of the Centre region in Cameroon. The aim of the present study was to estimate the prevalence of these helminths in two villages (Kedia and Ediolomo) of the Mbam and Inoubou subdivision after some years of mass drug administration. After the sensitization step, we started the prospection by the distribution of containers for faeces collection to all the volunteers of the two villages. The subjects who provided the faeces were registered. All the samples were brought back to the laboratory of Parasitology and Ecology of the University of Yaounde I, for detection of parasitic elements using Kato - Katz and Ritchie methods. Among 355 subjects that received the containers, 286 provided the stool, given a participation rate of 80.56%. The sample size included 116 males and 170 female subjects. The Kato-Katz method revealed a very low number of infected subjects (0.023%). The Ritchie analysis was more sensitive and revealed in Kedia and Ediolomo villages respectively infection rates of 1.5% and 1.1% for *A. lumbricoides*, 2.5% and 2.3% for *N. americanus*, 2.5% and 1.0% for *S. mansoni*, 3.4% and 0% for *S. guineensis*. Following the analyses, the prevalence did not significantly differ among villages, quarters, ages and sexes. Schistosomiasis and Soil transmitted helminthiasis infection rates found were very low compared to evels of 10.70% and 11.29% revealed respectively by Kengne (2010) and Essomba (2013) for *S. mansoni* in the same subdivision, suggesting that, the mass drug administration conducted by the National Control Program of schistosomiasis and soil-transmitted helminths in the centre region since 2010 has been effective in this subdivision. Ritchie method also revealed the presence of 2.0% and 6.8% of *Entamoeba histolytica* and 16.7%, 13.6% of *E. coli* respectively in Kedia and Ediolomo villages.

## 39 **EFFICACY OF OZOROA PULCHERRIMA ROOTS AGAINST SCHISTOSOMA MANSONI-INDUCED LIVER INJURY IN MICE**

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Schistosomiasis is a chronic parasitic disease caused by blood flukes of the genus *Schistosoma*. Its remains a public health problem. Currently, control of the disease relies on chemotherapy with praziquantel. However, the intensive use of Praziquantel has raised concerns about the possible emergence of drug-resistant schistosomes. Therefore, complementary and/or alternative antischistosomal drugs should be discovered and developed to ensure the effective control of schistosomiasis. The aim of this study was to assess the efficacy of *Ozoroa pulcherrima* on *Schistosoma mansoni*-infected mice. Methanolic extract (MeOH-Op) and his ethyl acetate fraction (EA-Op) were given to infected mice orally and daily at 100, 200 and 400 mg/kg for 28 days, beginning at 36th day post-infection. Praziquantel was use as reference drug. After sacrifice at 64th day post-infection, worm burden and fecal, liver and intestine ova count were determined. Hepatic function biomarkers as transaminases, total bilirubin, and total proteins were measured in the plasma. Oxidative stress was assessed by determining catalase activity, malondialdehyde and reduced glutathione levels in the liver. After treatment of *S. mansoni*-infected mice with MeOH-Op or EA-Op at 200 mg/kg, the results showed a significant reduction in worm burden by 68.50 % ( $p < 0.001$ ) and 49.49 % ( $p < 0.01$ ) respectively. Ova count were also significantly ( $p < 0.05$ ;  $p < 0.001$ ) reduced in feces (91.60 % and 73.72 %), liver (70.12 % and 46.81 %) and intestine (89.48 % and 66.26 %). *S. mansoni* infection induced liver injury with elevated activity of transaminases, total bilirubin level and decreased level of total proteins. Administration of MeOH-Op or EA-Op at 200 mg/kg to infected mice significantly ( $p < 0.001$ ) reduced the level of ALT by 47.71 % and 53.98 % respectively as well as total bilirubin level by 48 %. The decreased level of total proteins was improved after treatment with both MeOH-Op or EA-Op. In addition, the treatment succeeded to correct the elevated malondialdehyde concentration induced by the infection with a significant ( $p < 0.001$ ) reduction reaching 72.98 %. However, reduced glutathione level and catalase activity significantly increased after the treatment. These results suggest that the methanol extract of *Ozoroa pulcherrima* as well as its ethyl acetate fraction have antischistosomal, antioxidant, and hepatoprotective activities against *Schistosoma mansoni* infection.



## 40 **EPIDEMIOLOGY OF SCHISTOSOMIASIS AND SOIL-TRANSMITTED HELMINTHIASIS IN BAROMBI KOTTO AND BAROMBI MBO VILLAGES, SOUTH-WEST REGION OF CAMEROON.**

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Schistosomiasis and soil-transmitted helminthiasis are a major public health problem in Cameroon. Although the control of these diseases focuses mainly on mass drug administration using Praziquantel for schistosomiasis and Mebendazole for soil-transmitted helminthiasis, the deworming campaigns are still limited to school aged children. To extend the mass drug administration to the entire community, including all age groups of the population, an epidemiological study was conducted in Barombi Kotto and Barombi Mbo in order to assess the real epidemiological situation of these helminthiasis. Parasitological and malacological surveys were conducted in each of these two villages between October 2015 and Jun 2016. Parasitological surveys were conducted in schools and within communities. A total of 519 stools and 559 urine samples were examined using the Kato Katz and urine filtration techniques, respectively. Malacological surveys were conducted in four water points, and the natural infection rates of snail were assessed. The results of parasitological surveys showed the presence of only one species of *Schistosoma*, i.e. *S. haematobium* with overall infection prevalences of 46.1% in Barombi Kotto and only 3.5% in Barombi Mbo. The prevalences were 46.8% and 0% for preschool aged children (0 to 4 years), 45.7% and 0% for school aged children (5 to 14 years) and 49.1% to 6.0% for adults ( $\geq 15$  years) in Barombi Kotto and Barombi Mbo, respectively. The difference was not significant between school and community surroundings, sexes, age groups and schools in each village ( $P > 0.05$ ). Three species of soil-transmitted helminths were found, with overall infection prevalences of 4% and 7.5% for *Ascaris lumbricoides*, 2.6% and 9.8% for *Trichuris trichiura* and 0.5% and 9.8% for *Necator americanus* in Barombi Kotto and Barombi Mbo, respectively. For all three species, the infection prevalences were similar between sexes and age groups in each of the two villages. The malacological surveys allowed to collect a total of 924 snails in Barombi Kotto, belonging to four species: *Bulinus camerunensis* (56%), *Bulinus forskalii* (7.6%), *Indoplanorbis exustus* (31.9%) and *Lanistes libycus* (4.5%). At Barombi Mbo, 629 snails have been collected, including *Bulinus truncatus* (47.2%), *Bulinus forskalii* (51%) and *Lanistes libycus* (1.7%). The abundances snail intermediate hosts were higher in March and June in Barombi Kotto and in June in Barombi Mbo. All cercarial shedding tests were negative for all snails

collected in Barombi Mbo, whereas for Barombi Kotto, some *B. camerunensis* collected in June were infected with an infection rate of 1.7%. Our results showed that the endemicity level of schistosomiasis was moderate in Barombi Kotto and low in Barombi Mbo, while the endemicity of soil-transmitted helminthiasis was low in both villages. Interestingly, their similar distribution in all age groups, highlighted the necessity to extend the mass drug administration to the whole population and to implement others control strategies in these villages.

## 41 **MOLECULAR VARIABILITY OF THE SECOND INTERNAL TRANSCRIBED SPACER (ITS-2) GENE OF RIBOSOMAL DNA AMONG SCHISTOSOMA HAEMATOBIIUM ISOLATES FROM CAMEROON**

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Schistosomiasis is a chronic disease and the latest estimates for sub-Saharan Africa are that it kills 200 000 people every year (Yang et al., 2013). Some 300 million people are probably infected (OMS, 2015) and 800 million more are exposed to infection (Young et al., 2012). Among the species of schistosomes infecting humans, *Schistosoma haematobium* is responsible for the largest number of infections in sub-Saharan Africa with an estimated 150 million people infected with this species (Amarir, 2014). Of the 150 million cases of *S. haematobium* infection in sub-Saharan Africa, 70 million are associated with hematuria, 18 million with bladder wall pathology, and 10 million with hydronephrosis leading to severe kidney disease and even bladder cancer (Webster et al., 2012). Recent data showed an increase of schistosomiasis transmission in Cameroon (Tchuem tchuente et al., 2012; 2013). This is partly attributed to the presence of potentially more pathogenic hybrid forms of the parasite with higher transmission capabilities in both intermediate and final host. Recovery of adult worms was realised as described by Duwall & Dewitt 1967. PCR-RFLP technique was used for amplification and digestion of ITS2 gene (Barber et al 2000). Phylogeny tree was generated by MEGA 5.05 software. The RFLP technique we used showed clearly that, all the strains analysed had *S. haematobium* profile except two isolates which were hybrids. Isolate Dja2 from Djalingo-kapsiki is probably a hybrid between *S. haematobium* and *S. bovis*. The second isolate Mba1 found in Mbafam is also a hybrid, probably between *S. haematobium* and *S. guineensis*. Our findings are of utmost importance due to the possible implications that the presence of hybrids may have on the disease dynamics and control strategies for these parasites. The acquisition of new genes through introgressive hybridization can lead to phenotypic innovation that can profoundly influence the evolution of disease.

## **SOCIAL DETERMINANTS FOR THE SUSTAINABILITY OF SCHISTOSOMIASIS AND STH CONTROL STRATEGY IN CAMEROON: LESSONS FROM EXPERIENCES IN EDEA HEALTH DISTRICT.**

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In recent years, awareness on the burden of Neglected Tropical Diseases (NTDs) have quite been increasing and control strategies set. Schistosomiasis and Soil Transmitted Helminths (STH) control programs privilege preventive chemotherapy with mass drug administration to specific target groups due to its cost effectiveness. This has been the strategy for about a decade in Cameroon. As a result, the burden of schistosomiasis and STH has reduced but prevalence remains. What can justify unsustainability of deworming programs? Social factors hinder sustainability in controlling and eliminating schistosomiasis and STH. A qualitative research was carried out in Edea health district in November 2016, which involved 61 participants shared out in 31 semi-structured interviews (health officers, health workers, teachers, community drug distributors, councils' staff, private water provider and community members), 3 focus group discussions with teachers and community members. As well as direct observation within the area (schools and community neighborhood). It highlights quite low access to potable water and behavior associated with hygiene and sanitation as critical issues of reinfection. Best water sources are assumed to be "forages". But they are few, hosted by private people or constructed by private water providers (mainly ALUCAM and CODAS). To take their bathes, do laundry, wash dishes, cook and drink, people mostly fetch water from "Camerounaise des

eaux" (public water provider) or wells, which quality is doubtful. Instead of paying transport of about 600 FCFA to go fetch potable water free of charge, women will rather use them to cook a pot of rice to feed their family.

Sewage systems are constructed to eliminate waste in rivers, where laundry and bathing are usually done. The hygienic conditions are such that children get reinfected about two weeks after treatment. Most schools don't have water sources and where available, they are not potable. Little attention is paid on using soap to wash hands after easing or cleaning feces and urines around school. As a matter of fact, school buildings with no fences are often vandalized and feces are deposited on benches and other instruments used for studies; the pupils are asked to clean them. Afterwards, they do not wash off dirt properly and contaminate themselves with eating at lunchtime.

In addition, deficiency in information dissemination to the community and decrease of community drug distributors' (CDDs) commitment also lead to refusals and losses in coverage. Repetition or non-spacing between campaigns and the fact that the therapies are not properly explained to those expected to receive it, make them reticent and reluctant to consume more drugs since they fear overdose and its consequences.

The decrease of CDDs financial motivation across the years in deworming campaigns diminishes their commitment to concerned programs. This implies extra work for willing CDDs and lower treatment coverage. Improvement of access to infrastructures and behavior associated with WASH (water, hygiene and sanitation), communication and sensitization, and CDDs working conditions deserve to be addressed in sight of eliminating schistosomiasis and STH. This should involve not only the health system. A policy coordinating action between local authorities, the health system and other public bodies is recommended as a key to a sustainable STH and schistosomiasis control strategy.

## **Contacts**

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## About the Centre Schisto



The Centre for Schistosomiasis and Parasitology (CSP) which was established in 1999, is the principal reference laboratory for parasitology research in Cameroon and plays a leading role in research and implementation of control strategies for schistosomiasis and soil-transmitted helminthiasis.

CSP provides a scientific and educational environment of the utmost standard and conducts innovative research aimed at improving the health of people in endemic areas of the country. By furthering understanding of the epidemiology and transmission of these diseases, and exploring the efficacies of different treatments, the Centre aims to radically improve the current situation in Africa

Although the parasites responsible for these diseases have been studied extensively, the epidemiology of infections and many aspects of their biology remain poorly understood. The CSP aims to address these knowledge gaps and establish a dynamic framework for high-level research in these areas. The CSP plays a seminal role in research for schistosomiasis and STH in Cameroon, translating its unique expertise into action to improve the health of those who need it most.

A robust knowledge of the distribution of parasites is essential to successfully confronting them. Work carried out at the CSP has enabled data on schistosomiasis and STH to be updated which in turn, enables efficient planning, coordination and evaluation of control activities in Cameroon.

By placing these diseases under the microscope, CSP has gained a wide range of scientific expertise and strengthens the research capacity of research teams both at national and international levels. This has resulted in a strong multidisciplinary partnership in the international parasitology community. The centre is linked to the University of Yaounde I, Cameroon and it assists the Ministry of health in the implementation of control activities and operational research.

The centre employs a multidisciplinary team of over 10 people, with in-depth knowledge in epidemiology, parasitology, disease control and surveillance. The team which has a vast experience in applied field research and the development of control programmes is comprised of researchers, lecturers, medical doctors, lab technicians, PhD and Master students.











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The Centre for Schistosomiasis and Parasitology offers a wide range of services for the scientific community, all pertaining to parasitological research. We have a range of well-equipped laboratory facilities and good functional infrastructure for high quality research, including:

- Parasitology laboratory,
- Biochemical and molecular laboratory,
- Snail room (Molluscarium),
- Animal room (Bioterium),
- Conference room,
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