



MAKERERE UNIVERSITY



Carnegie NERLP Project Dissemination Workshop

Book of Abstracts



THEME:

*Nurturing Emerging Research Leaders through Post-Doctoral Training
at Makerere University*

WORKSHOP PROGRAMME

Time	Activity	Responsible Person
08:00–09:00	Arrival and Registration	Secretariat
09:00–09:10	Remarks by the Project Coordinator, Makerere University	Prof. Buyanzi Mukadasi
09:10–09:20	Comments by the Chairperson, Project Implementation Committee	Assoc. Prof. Umar Kakumba
09:20–09:30	Remarks by the Vice-Chancellor, Makerere University	Prof. Barnabas Nawangwe
09:30–10:00	Key Note Address	Assoc. Prof. Ernest Okello-Ogwang
10:00–11.00	SESSION 1 CHAIRPERSON	Dr Nicholas Kiggundu
10:00–10:10	Tsetse Invasion Effect on Socio-Ecological Resilience of Pastoral Communities in Karamoja Sub-region, Uganda (SORES)	Dr Anthony Egeru
10:10–10:20	Structural Investigation of the Natural Products Composition of Selected Medicinal Plants used against Bacterial Infections in Uganda	Dr Jane Namukobe
10:20–10:30	The Extractive Industry in Uganda: Exploring the Environmental, Social and Economic Intricacies of Artisanal Gold Mining in Moroto District, Karamoja Region	Dr Eria Serwajja
10:30–10:40	The Political Ecology of Shea butter tree (<i>Vitellaria paradoxa</i> C. F. Gaertn.) Conservation in Uganda	Dr Patrick Byakagaba
10:40–11:00	DISCUSSION	Dr Nicholas Kiggundu
11.00–11:30	HEALTH BREAK	
11.30–12.30	SESSION 2 CHAIRPERSON	Dr Jesca Nakavuma
11:30–11:40	Campylobacter jejuni, Escherichia coli and Salmonella Prevalence, and Antimicrobial Resistance Profiles for Dairy Farms in Mukono District	Dr Sylvia Baluka Angubua
11:40–11:50	Effect of Host Genotype on Seropositivity of Ankole Cattle to Mycobacterium Avium Subspecies paratuberculosis	Dr Boniface Julius Okuni
11.50–12:00	Elucidating the Mechanism of Interaction of Mycobacteria Rhomboid Proteases with their Specific Substrates	Dr Pakoyo Fadhiru Kamba

Time	Activity	Responsible Person
12.00–12.10	Assessment of Aflatoxin Exposure among Peri-urban Low-income Populations in Kampala Capital City	Dr Abel Atukwase
12:10–12:30	DISCUSSION	Dr Jesca Nakavuma
12.30–12.45	SESSION 3 CHAIRPERSON	Assoc. Prof. Justine Namaalwa
12:30–12:40	Development of a Locally Sustainable Complementary Food Enriched with <i>Moringa oleifera</i> Leaves Suitable for Children 6-59 Months	Dr Gaston A. Tumuhimbise
12:40–12:50	The capacity of Moringa oleifera Leaf Extract to Improve Glycaemic Control of Type 2 Diabetes Patients Failing on Oral Hypoglycaemic Medicines	Dr Josephine Namuganwa Kasolo
12:50–13:00	Selected Persistent Organic Pollutants in Breast Milk, Blood and Placental Tissues of Mothers Living in Urban and Rural Areas, Uganda	Dr Patrick Ssebugere
13:00–13:20	DISCUSSION	Assoc. Prof. Justine Namaalwa
13:20 - 14:20	LUNCH	
14:20–15:00	SESSION 4 CHAIRPERSON	Dr Julius Kikooma
14:20–14:30	Enhancing Customer Relationship Management in Institutions of Higher Learning with the aid of Technologies (ICTs): A Case of Makerere University	Dr Jamiah Mayanja
14:30–14:40	An Assessment of the Implementation Strategies of Mother Tongue Education in Uganda: A Case of Northern Uganda	Dr Erisa Medadi Ssentanda
14:40–14:50	Adult Learning for Socioeconomic Transformation: Perspectives from Uganda	Dr Hannington Bananuka Twine
14:50–15:00	The Marketisation of Public University Education in Uganda: Implications for Quality Assurance in the Governance of the Teaching and Learning Processes	Dr Euzobia Baine Mugisha
15.00–15:20	DISCUSSION	Dr Julius Kikooma
15.20–15.50	CLOSING CEREMONY AND AWARD OF PLAQUES	Prof Buyinza Mukadasi
16:00	DEPARTURE	

FOREWORD BY THE DIRECTOR OF RESEARCH AND GRADUATE TRAINING



I extend my warmest welcome to you. Welcome to the Research dissemination workshop of the Carnegie-funded project entitled “Nurturing Emerging Research Leaders through Post-Doctoral Training at Makerere University, NERLP”, 2017 – 2019. The theme this year is Nurturing Emerging Research Leaders through Post-Doctoral Training, a topic that is quickly gaining traction in both academic and policy discussions because of the relevance of research leadership to the transformation of society.

It is our pleasure to welcome you to the Research dissemination Workshop. A major goal and feature of it is to bring academics, researchers, policy actors, and civil society together to exchange and share their experiences and research results about most aspects of science and social research, and discuss the practical challenges encountered and the solutions adopted.

The Carnegie Corporation of New York (CCNY) was one of the foreign partners that played a crucial role in the process of revitalization of Makerere University. Coincidentally, the Corporation’s current interests fits well within the University’s 10-year Strategic plan, 2020-2030, formulated to reposition herself to address emerging development challenges arising from globalization.

Over the last decade, a deliberate effort was made to build a critical mass of staff with PhDs. The last two decades have witnessed tremendous increase in the number of staff. In 2010, the Cooperation funded a project titled “Next Generation of African Academics (NGAA I) that focused on human resource development at the University through PhD and Masters’ training and was later extended to NGAA II to consolidate the gains of building, nurturing and retaining the Faculty at Makerere University. There are tangible fruits from these initiatives including the fact that presently out of 1400 academic staff, 50 percent (750) have PhDs while 40 percent (550) have Masters Degrees. Regardless of the discipline, these fresh PhD-holders require research training to enable them further a career in research before they resume active teaching and administrative responsibilities. Secondly, training has enhanced the expertise and capacity in the various disciplines to compete regionally and internationally.

Many of our senior Faculty agree that entry into a successful academic career is often an arduous process. From career preparation through to doctoral studies and beyond, the journey can be fraught with trials. Researchers are aware of the key elements to academic career progress especially concerning their research. Broadly this can be described as becoming an independent researcher with the ability to successfully gain funding and to demonstrate the impact of their work nationally and internationally. Becoming an independent researcher, however, brings with it other requirements, such as, taking on teaching and also being in a position of leading and managing a research team.

In reality, whereas the Cooperation has supported many Faculty to attain their PhD degrees, as Director of Research, I noted that early-career academics at Makerere University face considerable challenges in understanding and negotiating effective career paths. The common challenges encountered include the unclear and shifting expectations; lack of experience and skills in writing grant applications and manuscripts for publication due to an array of barriers including work overload; lack of effective mentors; poor research infrastructure; low levels of funding and a relatively poor research culture, lack of self-motivation, conflicting experiences in research, supervision and mentorship programs at the University. There was therefore, a need to consolidate the gains made and nurture these fresh PhD graduates by providing research

funds to train them in research leadership including grantmanship, academic writing, supervision, mentorship, scientific communication, policy-dialogue and negotiation.

It is heartwarming to report that the postgraduate training and postdoctoral research under NERLP project has appreciably helped to strengthen the early-career academics' research skills and turned many into research leaders that are capable of writing grant applications, publishing their research results, supervision and mentoring graduate students, and transforming society through policy dialogue. Given the current staffing constraints at Makerere University, this project's architecture fits well because it was difficult to grant them sabbatical study leave. It is for this reason that the fellows have conducted their research projects within the country with short research visits to regional Universities and research institutions and travel to disseminate research findings at international conferences.

The success of the NERLP project has depended completely on the effort, talent, and energy of postdoc fellows who have written and submitted papers on a variety of topics. Praise is also deserved for the University management, the Project Coordination Team at the Directorate of Research, and Graduate Training, the Program Implementation Committee, mentors and researchers for their devotion to research that has yield into phenomenal policy recommendations. My sincere appreciation to the scientific committee who have invested significant time in analyzing and assessing multiple papers, who hold and maintain a high standard of quality for this workshop. Additional thanks are given to the Carnegie Corporation of New York for the financial support.

Special thank you to Ms. Andrea Johnson, Program Director, Higher Education and Research in Africa, International Programs, Carnegie Corporation of New York.

We look forward to seeing all of you again at our next dissemination conference.



Professor Buyinza Mukadasi

DIRECTOR

DIRECTORATE OF RESEARCH AND GRADUATE TRAINING

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Tsetse Invasion Effect on Socio-Ecological Resilience of Pastoral Communities in Karamoja Sub-region, Uganda (SORES)

Project Team



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- **Graduate Student:** Joseph Opio and Paul Magaya
- **Mentor:** Justine Namaalwa

Introduction

Tsetse flies remain one of the significant vectors with devastating effects on human and livestock health affecting over 70% of Uganda. Karamoja sub-region has seen a resurgence in tsetse invasion thus further threatening livestock production in the sub-region. Livestock is crucial in food security and economic wellbeing of households in the sub-region.

Objectives

This SORES project sought to strengthen epidemiological surveillance of tsetse fly in the sub-region. The project specifically:

- 1) mapped and characterised tsetse fly spatial distribution in Karamoja sub-region;
- 2) determining factors influencing tsetse fly distribution and prevalence in Karamoja sub-region; and
- 3) determined the effect of tsetse fly socioecological invasion resilience in Karamoja sub-region.

Vector surveillance through fly traps, GIS, cross-sectional survey and focus group discussions were employed to gather relevant data from the sub-region.

Key Research Outputs

Publications

Egeru, A., Opio, J., Siya, A., Barasa, B., Magaya, J. P., Namaalwa, J. J. (2020). Tsetse invasion as an emerging threat socioecological resilience of pastoral communities in Karamoja, Uganda. *Sustainability*, 2020, 12, 1599. DOI:10.3390/su12041599

Submitted manuscripts

Egeru, A., Magaya, J. P., Kuule, D. A., Siya, A., Gidudu, A., Barasa, B., Namaalwa, J. J. (2020). Savannah phenological dynamics reveal Spatio-temporal landscape heterogeneity in Karamoja sub-region, Uganda. *Frontiers in Sustainable Food Systems* (manuscript responded to reviewer comments).

Policy briefs

- 1) Tsetse invasion in Karamoja, Uganda: An emerging threat socioecological resilience.
<https://repository.ruforum.org/sites/default/files/Final%20Policy%20Brief%20on%20Tsetse%20Fly%20Policy%20Brief-2.pdf>
- 2) Assessment of tsetse fly invasion on social-ecological resilience of the people of Northern Karamoja. <http://afrifood.org/wp-content/uploads/2020/04/Assessment-of-tsetse-fly-invasion-on-Social-Ecological-Resilience-of-the-people-of-Northern-Karamoja.pdf>
- 3) Detecting the length of the growing season using Savannah Vegetation Phenology in Karamoja. <http://afrifood.org/2020/04/30/detecting-the-length-of-the-growing-season-using-savannah-vegetation-phenology-in-karamoja/>

Besides our work shared on Makerere University and Afrifood websites, the work has been re-shared by two important dissemination channels:

- 1) IDEASs: <https://ideas.repec.org/a/gam/jsusta/v12y2020i4p1599-d323196.html>
- 2) Coalition of European Lobbies for Eastern African Pastoralism (CELEP) <http://www.celep.info/tsetse-threat-to-resilience-of-karamoja-pastoralists/>

Innovations Arising from the Project

We created AfriFood (<http://afrifood.org/>), a non-governmental organisation focused on delivering innovations to enrich lives. It was as out of the realisation that much of the research from the universities hardly finds its way to the communities

and the engagement of universities/researchers with the communities is limited. Many of the NGOs operating at the community level are not research-driven. So far AfriFood website has been visited by over 34,000 people in its one year of existence. We have been able to reach out to 11,000 people during our dissemination activities and, in particular, during COVID-19 onset period. Some of our collaborative work in Karamoja is available here: <https://youtu.be/AbjO6-TeQVk>

Impact to the Society, University and Research Community

Since we launched the AfriFood.org platform, there is a lot of engagement with other actors in the sub-region. We have witnessed acceptance from the civil society as evident in our participation in several activities of their activities. We have thus been able to articulate the voice of the universities and the role of research in development using a civil society platform. Thus, engagement and impact are at several levels:

- 1) Representation of the voice of the University/research fraternity in various fora.
- 2) We were taking advantage of COVID-19 to educate the communities about vectors, vermin and problems caused by human-wildlife interaction. We highlighted the need to keep environmental integrity to secure communities from avoidable zoonotic diseases.

Challenges and Lessons Learnt

- 1) Adaptive research delivers a lot of benefits and generates interest and willingness of communities to participate. They see where their immediate benefits and how the research is relevant to them.
- 2) Universities need to re-orient the engagement and dissemination processes. For long, we have been aloof from the realities; we simply seek to collect data for data's sake, run the analysis and get excellent p-values and papers. Universities can do much more in the research process to get quality outputs whilst catalysing development processes at the community level.
- 3) The security situation in Karamoja changed between June 2019 and May 2020; there were renewed raids and counter raids, especially in north Karamoja (Kotido and Kaabong districts). These affected our implementation timelines.
- 4) Post-Doc outputs are beyond the project support provided. The DRGT should do more to capture outcomes beyond the funded project.

Structural Investigation of the Natural Products Composition of Selected Medicinal Plants Used against Bacterial Infections in Uganda

Project Team



Principal Investigator:

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- **Graduate Student:** Betty Imalingat
- **Mentor:** Robert Byamukama

Introduction

Bacterial infections are a common cause of illness and death in sub-Saharan Africa. Moreover, severe bacterial infection is one of the principal determinants of morbidity and mortality. Antibiotics have saved millions of lives. However, antimicrobial resistance has threatened this progress and presented significant risks to human health, leading to a continuing search for newer and more potent antibiotics. Plants have provided new sources of alternative medicine and antibiotics. The project focused on documenting plants for bacterial infections in Mpanga and Mabira forests, testing for their antibacterial potentials as well as isolating and identifying their bioactive compounds. One hundred forty (140) plant species were recorded for medicinal purposes to manage various ailments, including bacterial infections. *Solenostemon latifolius* was selected and investigated for its antibacterial potential and chemical constituents. The plant has good antibacterial activity with MIC less than ≤ 0.1 Mg/MI due to the presence of Coleone U, and a compound found to have good antibacterial activity. These results indicate that these plants have potential in treating bacterial infections and other ailments. One can use them in the formulation of standardised herbal remedies as well as the development of drugs to combat resistant bacterial strains.

Objectives

The project aimed to identify and chemically characterise bioactive metabolites from plants with antibacterial potentials. The specific objectives of the project were to:

- 1) Determine the antibacterial activity of extracts from plants used against bacterial infections.
- 2) Isolate and elucidate the structures of antibacterial compounds.
- 3) Determine antibacterial activity of the isolated pure compounds.

o Methodology

We carried out an ethnobotanical survey around Mpanga and Mabira forests on plants used traditionally for bacterial infections and other infections. *Solenostemon latifolius* (*Ekibwankulata*) was selected for further laboratory analysis to determine its efficacy and chemical constituents. We tested the extract and isolated compounds for their antibacterial potentials using the disc diffusion procedure. We used both chromatographic and spectroscopic methods to determine the structure of the isolated compounds.

Key Research Outputs

Submitted manuscripts

- 1) The team submitted one manuscript entitled “Ethnobotanical documentation of traditional knowledge about medicinal plant species used by communities around Mabira and Mpanga Central Forest Reserves, Uganda,” to the *Journal of Herbal Medicine*.
- 2) Another manuscript entitled “Antibacterial activity and characterisation of compounds from the leaf extract of *Solenostemon latifolius* Hoscht ex” is ready for submission.

Impact to the Society, University and Research Community

- 1) The team conducted outreach to communities of Mpanga, Mabira, Kayunga and Buyende where we trained the local community on how to make standardised herbal jelly, herbal cream, herbal soap and detergents. Some of the groups we trained have already put the skills into practice during this COVID-19 pandemic.
- 2) The research team also conducted a workshop in the Department of Chemistry to train students and staff in how to make standardised herbal jelly, herbal cream and herbal soap. Some of the students have already used this knowledge to make liquid soap during the COVID-19 pandemic.

- 3) The knowledge obtained from this research will be useful for many researchers, especially the chemists and pharmacologists, to study these plants further or formulate herbal medicine from the plant that was analysed.
- 4) Through the mentorship process, I am now part of many international and national bodies. For instance, I am the appointed assistant secretary to Natural Product Research Network for East and Central Africa (NAPRECA). I also participated in organising the NAPRECA-Uganda chapter conference, which took place on April 5, 2019, at Makerere University.

Challenges and Lessons Learnt

- 1) Lack of instrumentation for structural determination in the country/region.
- 2) However, effective collaboration helps you overcome challenges like a lack of resources and expertise. In this way, you can build on the positive results of your research.
- 3) As researchers in natural products and drug discovery, we do not have to wait for the long journey of drug discovery to impact the community. We can use the resources that we have to come up with formulations that can help the local population immediately.

The Extractive Industry in Uganda: Exploring the Environmental, Social and Economic Intricacies of Artisanal Gold Mining in Moroto District, Karamoja Region

Project Team



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- **Graduate Student:** Derrick Senyonga
- **Mentor:** Paul I. Mukwaya

Introduction

The project examines the intricate dynamics which underpin the extractive industry in Uganda, particularly the environmental, social and economic implications of artisanal gold mining on the local communities of Moroto and Amudat districts in the Karamoja sub-region.

Project Objectives

Four research questions guided the research. First, examine Uganda's 'gold value chain' and 'footprints' using Moroto and Amudat districts as the case study sites. Second, examine the emerging gendered dynamics associated with gold mining in Moroto and Amudat districts. Third, explore the environmental and socioeconomic impacts of artisanal gold mining in Moroto and Amudat districts. Fourth, establish ways in which men, women and children have responded to and navigated the challenges encountered in artisanal goldfields of Moroto and Amudat districts.

Methodology

The study employed a qualitative research design and methodology, with multiple ethnographic methods: interviews, focus group discussion and observation, used to collect the data.

Results

The findings indicate that surface and sub-surface mining processes are causing a myriad of environmental problems on land, water, to the miners and the local communities. Although artisanal gold mining provides women with diverse opportunities, including employment and possibilities to earn an income, most of the lucrative mining opportunities are not available to them. Instead, the majority of women are engaged in undervalued, less-lucrative, and less-remunerated but labour-intensive support work that mirrors their domestic household routines. This contributes to their marginalisation in society. Moreover, socio-cultural and conventional moralities and practices are continually manipulated, thereby legitimising the exclusion of women from specific mining activities.

From an environmental perspective, we established that mercury had polluted most of the gold mines, with the levels exceeding national and international (WHO) acceptable standards. Among the most severe environmental problems caused by artisanal mining at the case study sites in Moroto and Amudat districts is the discharge of mercury tailings on land and in water bodies. All the soil samples analysed from the study sites evidenced mercury concentrations that were above the minimum acceptable limit of 0.03 mg/kg for total mercury content in the soil. This denotes high toxicity of mercury in the ground within and around the selected mining areas in both Moroto and Amudat districts. For the water samples, the results indicate that all the sampled sites had low elemental mercury levels below the detection limit of 0.1 mg/l for both seasons, except for Nacabat and Karita sites in the dry season. However, although most mercury pollution levels in the water were below detectable levels, there were noticeable impacts within and around the mines. First, women and children, whose main activity in the mines is panning and washing of gold, reported severe skin irritation, cracking of hands and feet, with some getting 'permanent' skin disorders. We attributed this to the polluted water in which women and children directly step while panning and washing gold ore. All the miners do not have any protective gear. High mercury levels could cause various ailments to the miners, including dermatitis, which damages the brain and kidneys. It also appears that mercury is polluting the soil, ground and underground water sources, with higher possibilities of polluting the food chain.

Key Research Outputs

Publications

Condemned to the periphery: The lived experiences of women in artisanal gold mining activities in Karamoja sub-region, Uganda. This article explores the lived experiences

of women engaged in artisanal gold mining activities at Lolung and Chepkararat mines in Karamoja, north-eastern Uganda. Although artisanal gold mining provides women with diverse opportunities, including employment and possibilities to earn an income, our results suggest that most of the lucrative mining opportunities are not available to them. Instead, the majority of women are engaged in undervalued, less-lucrative, and less-remunerated, labour-intensive support work that mirrors their domestic household routines. This adds to their marginalisation in society. Available at: [https://authors.elsevier.com/sd/article/S2214-790X\(20\)30266-5](https://authors.elsevier.com/sd/article/S2214-790X(20)30266-5)

Submitted manuscripts

Environmental Intricacies of Artisanal Small-scale Mining in the Gold-rich Landscapes of Karamoja, North-Eastern Uganda. This manuscript has been submitted to the mentor for final edits before submission.

Policy briefs

We submitted a shorter version of the published manuscript to The Conversation Africa for dissemination to the broader audience.

Innovations Arising from the Project

The outcomes of the project, particularly the extent to which artisanal mining is altering the natural environment and degrading the fragile ecosystems in the countryside with mercury pollution levels exceeding national and international (WHO) standards, are worrying. This has motivated the research team to partner with the two districts to sensitise the artisanal miners on the harmful effects of mining on the environment.

Impact to the Society, University and Research Community

During the dissemination workshop, the team informed the miners of how artisanal gold mining activities were reshaping the gender dynamics in the mining villages. Also, miners got detailed information on the complex ways in which mining activities are progressively altering the fragile ecosystems in Karamoja sub-region.

The Political Ecology of the Shea Butter Tree (*Vitellaria paradoxa* C. F. Gaertn.) Conservation and Use in Northern Uganda

Project Team



Principal Investigator:

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- **Co-PI:** David M. Tumwesigye
- **Graduate Student:** Jimmy Ouna
- **Mentor:** John Bosco L. Okullo

Introduction

The Shea butter tree (*Vitellaria paradoxa*) is one of the “reserved” trees by law in Uganda. It has socio-cultural, economic and ecological values to various actors whose interests are often parallel. The flagship product from this tree is the shea butter, obtained from the nuts and used in food, cosmetic, confectionery, pharmaceutical industries and in cultural practices. The wood is used for making charcoal. The conflicts over the uses of this tree, in turn, affect its ecology.

Using a political ecology approach to understand how the conservation of this tree is articulated and executed at different levels has not been tried in Uganda. Here, protection of species is often not guided by biological or ecological necessity but by political interests of particular groups.

Objectives

By providing a better understanding of the discourses shaping conservation of the Shea butter tree in Uganda, the project aimed at determining strategies for sustainable use of indigenous trees. The specific objectives were to:

- 1) Assess the effects of existing narratives and interests on conservation of the shea butter tree in Uganda;
- 2) Examine existing power dynamics among actors involved in the preservation and use of shea butter tree;
- 3) Assess the sources of motivation for the sustainable management of the Shea butter tree; and
- 4) Assess interventions required to enhance sustainable management of the Shea butter tree.

Methods

The team conducted the study in Otuke and Agago districts in northern Uganda. We applied exploratory, descriptive and interpretive research designs using qualitative and quantitative methods of assessments. We collected data using key informant interviews, focus group discussions, semi-structured household interviews, and document review. For analysis of data, we applied narratives and content analysis.

Results

Regulators; shea fruit collectors, processors and traders; herbalists, spiritualists and traditional leaders; Non-Governmental Organisations; and charcoal dealers were the actors that shaped narratives on shea butter tree conservation. The environmental crisis narrative was the most dominant among all actors except charcoal dealers. They posited that this tree is threatened by charcoal dealers and thus risk extinction. This is negatively affecting livelihoods, food security, income and export earnings from shea nuts. The charcoal dealers presented a narrative that was not dominant, which portrayed the tree as a safety net for income through conversion into charcoal. They perceived the restrictions as limiting their rights to use the tree.

The study also found that regulators have structural power which they exercise through enacting and enforcing laws on this tree. Conservation organisations use discursive power and incentives to promote non-wood extractive uses of the tree. Charcoal dealers use their economic power and connections with powerful elites not to comply with the laws that restrict the use of this tree for charcoal.

In Otuke, addressing the threat of charcoal was the most mentioned motivation for the conservation of the tree while in Agago, the main driver was the cultural value of the crop. Therefore, in Agago, the enforcement of traditional rules helped to sustain this tree while, in Otuke, incentives were used to plant and conserve it.

Conclusion

There is a contest between actors promoting the dominant perspective of non-wood use and the non-dominant view of wood extraction for charcoal. Conservation and sustainable management of the shea butter tree require enhanced enforcement of traditional rules, statutory law, and incentives for planting and maintaining them on private land.

Recommendations

- 1) Promote integrated planning for the shea tree.
- 2) Improve coordination and capacity of agencies.
- 3) Address drivers of shea tree conservation.
- 4) Promote multi-level governance.
- 5) Codify the traditional rules.
- 6) Provide subsidies and incentives.

Key Research Outputs

Submitted manuscripts

Three manuscripts under development:

- 1) The principle of subsidiarity: A pathway to sustainable management and use of the shea-nut tree in northern Uganda?
- 2) Power relations in the conservation and use of the shea-nut tree in northern Uganda.
- 3) Drivers for the sustainable management, conservation and use of the shea-nut tree in northern Uganda.

Innovations Arising from the Project

We identified tools and the lenses to interrogate power relations in the conservation of indigenous trees.

Impact to the Society, University and Research Community

The project provided information that was useful in the formulation of the Charcoal Policy for Northern Uganda. The REDD+ strategy of Uganda includes consideration of trees on the farm, such as the shea-nut tree.

Challenges and Lessons Learnt

- 1) Conducting final data collection and dissemination was delayed by COVID 19.
- 2) The graduate student had a car accident; he sustained severe injuries.
- 3) Qualitative studies especially using a political ecology lens require tact, flexibility, adaptability and more time in the field.

Prevalence and antimicrobial susceptibility profiles of *Campylobacter jejuni*, *Escherichia coli* and *Salmonella* in a peri-urban dairy farming community in Uganda

Project Team



Principal Investigator:

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- **Co-PI:** Lubowa Nathan Musisi
- **Graduate Student:** Buyinza
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- **Mentor:** Francis Ejobi

Introduction

Repeated cross-sectional studies were conducted for one year from 06/2018 to 06/2019 to assess the prevalence and antimicrobial susceptibility profiles of *Campylobacter jejuni*, *Escherichia coli* and *Salmonella*. We collected a total of 184 samples from 33 dairy farms. Bacterial isolation was by agar surface streaking and broth dilution. Only *Escherichia coli* was isolated and confirmed by IMViC. *Escherichia coli* was isolated from 40 (21.7%) samples; 37/65 (56.9%) faecal and 3/629 (4.8%) water respectively; and from both faecal and water samples from one farm. *Escherichia coli* isolates antimicrobial susceptibility testing (AST) was by single disc diffusion method against eight antimicrobial agents and reported using the sensitive, intermediate and resistance (SIR) system.

All the 40 isolates were resistant to oxacillin, susceptible to gentamycin, ciprofloxacin, cefoxitin and cefotaxime. While 39 (97.5%) were sensitive and 1 (2.5%) was resistant to ceftazidime and ceftriaxone. Twenty-three 23 (57.5%) were sensitive, 10 (25%) showed intermediate susceptibility and 7(17.5%) were resistant to ampicillin. Six (15%) were resistant to ampicillin and oxacillin. Twenty-two (59.5%) were sensitive, 9 (24.3%) intermediate and 6 (16.2%) resistant to ampicillin. Thirty-six (97.3%) isolates from faecal samples were sensitive, and only 1 (2.7%) was resistant to ceftazidime and ceftriaxone.

We do not recommend oxacillin for treating bacterial infections to avoid treatment failures. Public education and policy actions should encourage rational use of the

antimicrobial agents that are still effective against microbial agents to prevent or delay antimicrobial resistance.

Effect of Host Genotype on the Seropositivity of Ankole Cattle to *Mycobacterium avium subspecies paratuberculosis*

Project Team



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Introduction

Mycobacterium avium subspecies paratuberculosis is responsible for chronic debilitating disease in cattle associated with severe economic losses and reduced profitability of many livestock enterprises worldwide. In Uganda, the disease, paratuberculosis is an emerging threat in both commercial and traditional cattle farming; however, the choices of control require several concerted efforts, that are currently not in place.

Objectives

This project aimed to explore the potential use of resistance and susceptibility markers in key gene polymorphisms that could be used to control the disease among Ankole cattle. The specific objectives were:

- 1) To determine the seroprevalence of MAP in Ankole cattle in Rakai, Lyantonde and Isingiro districts.
- 2) To determine the allele frequencies of single nucleotide polymorphisms in TLR4, IFNG, NOD2, SCL11A1 and PGLYRP1 in seropositive and their case controls.
- 3) To determine the genetic association of individual SNPs and infection status of Ankole cattle exposed to MAP.

Methodology

In order to determine the prevalence of MAP infection in Ankole cattle in Isingiro, Rakai and Lyantonde districts, a multistage sampling method was used to collect

blood from cattle in the three districts. Serum was extracted and tested for antibodies of MAP using ELISA. MAP Positive cattle and MAP negative cattle from the same herds were identified as cases and controls and genotyped using MassARRAY single-base extension method. Analysis of the genotypic differences between cases and controls was done using SHEsis software to determine the allele frequencies, genotype frequencies, χ -Square values, odds ratio, and p-values.

Key Research Outputs

Publications

Single nucleotide polymorphisms in SLC11A, TLR4, NOD2, PGLYRP1 and IFN γ show limited effect on seropositivity of Ankole Long-horned cattle in Uganda to Mycobacterium subspecies paratuberculosis, Frontiers in Veterinary Research.

In this paper, we report the allele and genotyping frequencies of 13 different single nucleotide polymorphisms in 5 genes, namely Toll-like receptor 4 (TLR4), Solute like carrier 11A1 (SCL11A1), Interferon-gamma (IFN γ), peptidoglycans recognition protein 1 (PGLYRP1) and NOD2. Only one SNP in PGLYRP1 was statistically over-represented in seropositive cattle indicating that it contributes to susceptibility to MAP, while another SNP in SCL11A1 is marginally significant.

Submitted manuscripts

One article is under development: *Epidemiological characteristics and seroprevalence of Mycobacterium avium subspecies paratuberculosis infection in Ankole cattle herds in Lyantonde, Rakai and Isingiro districts in Uganda.* In this paper, we describe the prevalence of MAP in the three districts and the epidemiological factors and practices that are associated with seropositive herds in these districts.

Impact to the Society, University and Research Community

The information generated in this study will help in making choices for interventions in the control of paratuberculosis in cattle in the study area and the neighbouring districts.

Challenges and Lessons Learnt

Paratuberculosis is indeed a threat in Ankole cattle, but control still remains difficult since there are too many variables. Genetic association studies are very expensive and need high throughput methods like genome-wide association studies to cover all genetic variations.

Elucidating the Mechanism of Interaction of Mycobacteria Rhomboid Proteases with their Specific Substrates

Project Team



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Introduction

Mycobacteria cause very devastating diseases in humans, such as tuberculosis (TB). An efficacious vaccine against TB is lacking as BCG does not confer protection in adults. Early, effective treatment of TB is essential to the prevention of fatalities. However, there are few drugs that are effective against mycobacteria. Besides, multi-drug resistant (MDR) TB has escalated greatly. Thus, there is a need for the development of novel TB therapeutics. Among novel molecular targets, the rhomboid family of intramembrane serine proteases has recently emerged in mycobacteria. Mycobacteria genomes encode two rhomboid proteases, 1 and 2. Characterisation of the mode of action of these proteins is necessary for drug design.

Objectives

To elucidate the mechanism of interaction of mycobacteria rhomboid proteases with their native substrates. Specific objectives were to:

- 1) Identify the native peptide substrates for mycobacteria rhomboid proteases;
- 2) Elucidate the substrate residues that interact with mycobacteria rhomboid proteases; and
- 3) Elucidate the mycobacteria rhomboid protease residues that interact with substrates.

Materials and methods

Rhomboid protease 1 DNA for *Mycobacterium smegmatis* and *Mycobacterium tuberculosis* were amplified from genomic DNA by polymerase chain reaction (PCR) and cloned into the pMAL-c5X overexpression plasmid harbouring an N-terminal maltose-binding protein (MBP) solubility enhancer. Recombinant plasmids were then transformed into NEB® Express *E. coli* heterologous protein expression host. Transformants were grown in 2YT medium containing 0.2% glucose to suppress leaky expression till rapid growth phase when protein expression was induced by 0.5 mM IPTG (isopropyl- β ,D-thiogalactopyranoside). We analysed protein expression by denaturing sodium dodecyl sulfate-polyacrylamide gel electrophoresis. We also mutated the catalytic serine-histidine dyads of rhomboid protease 1 in the recombinant DNA of *M. tuberculosis* and *M. smegmatis* to alanine to compromise their catalytic potential using Phusion site-directed mutagenesis.

Results

We have cloned the full coding sequences of *M. tuberculosis* and *M. smegmatis* rhomboid protease 1 into the MBP-containing pMAL-c5X overexpression plasmid. After suppressing leaky expression using low glucose concentration, we have obtained modest expression for *M. smegmatis* rhomboid protease 1 but not *M. tuberculosis*. We are continuing to optimise the expression conditions for the *M. tuberculosis* rhomboid by expanding trials of post-induction temperature, inducer concentration, and different *E. coli* expression hosts. We have also conducted site-directed mutagenesis of both the *M. tuberculosis* and *M. smegmatis* rhomboid protease 1 recombinant plasmid DNA. However, the quality of sequences has so far been poor to identify mutant DNA samples. Optimisation of DNA sequencing conditions is ongoing.

Conclusions

We have developed a system to produce recombinant *M. smegmatis* rhomboid protease 1 for ligand binding and catalysis studies. The heterologous expression for *M. tuberculosis* rhomboid requires further optimisation.

Key Research Outputs

Submitted manuscripts

Our first manuscript is undergoing revision by the authors. We expect that it will be submitted to a journal by mid-November.

Innovations Arising from the Project

Our recombinant mycobacteria rhomboid-protease 1 plasmid constructs are a novel creation. However, the innovation will be complete after we successfully purify rhomboid protease from these constructs.

Impact to the Society, University and Research Community

These include:

- 1) Training of young scientists in recombinant protein production and engineering. Mentors are currently reviewing the student's thesis.
- 2) Career development of the graduate student. With the support of his mentors, he won a grant of UGX 158 million from the Makerere University Research and Innovations Fund for heterologous production of recombinant SARS-CoV-2 spike protein. This work will strengthen local capacity for the development of COVID-19 diagnostics and vaccines.
- 3) A research manuscript writing workshop was held for staff and graduate students of the Department of Pharmacy. This produced 13 draft research manuscripts which are being finalised for submission to refereed journals.
- 4) A systematic review writing workshop is scheduled for October 19th-24th 2020. This is expected to produce at least five systematic review protocols and five systematic review manuscripts for submission to refereed journals.

Challenges and Lessons Learnt

Mycobacteria rhomboid protease DNA has a very high concentration of guanines and cytosines, which makes PCR and DNA sequencing difficult exercises requiring extensive optimisation. Secondly, mycobacteria rhomboid proteases turned out to be toxic to *E. coli*, our heterologous protein production host and necessitated the addition of remedial procedures to succeed. Thus, preliminary experiments took more time than usual. We could have circumvented extensive preliminary optimisations by optimising the mycobacteria rhomboid DNA sequences to those used by *E. coli*. However, this would require artificial synthesis of the codon-optimised rhomboid protease DNA, which was expensive for the project.

Assessment of Aflatoxin Exposure among Peri-urban Low-Income Populations in Kampala Capital City

Project Team



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Introduction

The majority of low-income earners living in peri-urban areas of Kampala Capital City (KCC) depend on maize and groundnuts as their staple foods. These food items are usually purchased from markets and retail shops and are prone to aflatoxin contamination. Aflatoxin contamination of food in Uganda has been reported to increase along the value chain. Studies have so far indicated that the majority of the maize and groundnuts sold in Kampala markets are contaminated with aflatoxins to levels higher than the 10 ppb limit set by the Uganda National Bureau of Standards¹. It was therefore hypothesised that most peri-urban dwellers in KCC were at a high risk of aflatoxin exposure since maize and groundnuts form a large proportion of their daily meals.

Objectives

The main objective of the project was to assess the effect of dietary aflatoxin exposure on the health of low-income peri-urban dwellers in Kampala Capital City. The specific objectives were to:

¹ Osuret, J., et al. (2016). Aflatoxin contamination of selected staple foods sold for human consumption in Kampala markets, Uganda. *Journal of Biological Sciences*, 16(1), 44.

- 1) Assess the determinants of aflatoxin exposure among children (6-59 months) and mothers of reproductive age (15-49 years)
- 2) Estimate aflatoxin exposure among children (6-59 months) and mothers of reproductive age (15-49 years)
- 3) Characterise the risk of consuming aflatoxin-contaminated foods among Kampala peri-urban dwellers.
- 4) Design and disseminate aflatoxin Information, Education and Communication materials for improved awareness and reduction of aflatoxin exposure among the low-income populations living in peri-urban areas of Kampala Capital City.

Methodology

The study was conducted in two divisions of KCC, namely: Nakawa and Rubaga, targeting low-income households with children 6-59 months. A cross-sectional survey was undertaken to collect information on socio-demographics, food consumption, and food handling and preparation practices using a structured questionnaire. From each household interviewed, a sample (125g) of maize and groundnuts the family was feeding on at the time of the survey was collected. The food samples were analysed for total aflatoxins using ELISA Ridascreen® (R-Biopharm, Darmstadt, Germany). Total aflatoxin exposure was estimated probabilistically based on a triangular distribution and 10,000 simulations using @Risk Software (Palisade, Ithaca, USA). The risk associated with consumption of aflatoxin-contaminated maize and groundnuts was assessed based on the Margin of Exposure (MoE)². Risk of Hepatocellular Cancer (HCC) was estimated based on the carcinogenicity potency of aflatoxin B1 and the estimated daily aflatoxin intake.

Results

The study covered 372 households of which 78.8% were headed by males while 18.5% were female-headed. The majority (51.9%) of mothers/caregivers were housewives. Maize flour and groundnuts were consumed by 83% while groundnuts were consumed by 75%. The average weekly consumption of maize and groundnuts was 4 and 2 days, respectively. Individual tastes and preferences (39%) and price (53%) were the major factors influencing food choices. Aflatoxins were detected in 28% of the maize flour samples, while 76% of the groundnut samples tested positive. The mean aflatoxin content in maize flour and groundnuts was 27.86 (0.041 - 345.78) and 37.94 (0.041 - 296.42) µg/kg respectively. The mean total aflatoxin exposure was

² Benford, D, et al. (2010). Application of the margin of exposure (MOE) approach to substances in food that are genotoxic and carcinogenic. *Food and Chemical Toxicology*, 48 Suppl 1:S2-24.

higher among children (372.04 ng/kgBW/day) compared to women (312.41 ng/kgBW/day). The risk of HCC among women and children was estimated at 5.93 and 4.37 cancers/year/100,000 individuals, respectively. The study findings generally indicate higher exposure to aflatoxins and a higher risk of HCC among the low-income peri-urban population in KCC.

Key Research Outputs

The research supported an MSc student who is in the final stages of writing the thesis. The research team is currently drafting a manuscript for publication in a peer-reviewed journal. Information, Education and Communication (IEC) materials are also under development. The IEC materials will be disseminated in the project areas with the aim of increasing awareness on the negative health effects of aflatoxins and reducing dietary exposure.

Innovations Arising from the Project

The study findings inspired the team to develop a proposal to undertake a countrywide study of aflatoxin exposure and risk assessment. The proposal won a grant a research grant worth UGX 204,400,900 from Makerere University Research and Innovations Fund (MakRIF).

Impact to the Society, University and Research Community

The findings of this study will contribute to our understanding of the extent of aflatoxin exposure in the country and the risks associated with aflatoxin contamination of foods. The findings of the study will also contribute towards the ongoing efforts aimed at designing strategies for management of aflatoxins.

Challenges and Lessons Learnt

The main challenge was in how to harmonise the red tape procurement bureaucracy and the tight project timelines.

The grant provides a great opportunity for mid-career researchers to strengthen their research skills and should be maintained. However, the management of the fund can be improved by allowing flexibility in the budget lines. More funds should be allocated to research.

Development of a Locally Sustainable Complementary Food Enriched with *Moringa oleifera* Leaves Suitable for Children 6-59 months

Project Team



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Introduction

Moringa is a special tree with great medicinal and nutritional properties. It has been known to have a lot of economic benefits in the areas of medicine and industrial use. This miracle tree is known to have a high nutritional content for major nutrients including protein and micronutrients such as iron, zinc, manganese, group B vitamins as well as *beta* carotene the precursor of vitamin A. Moringa has enormous potential as a source of food in the tropics because the tree is in full leaf at the end of the dry season when other foods are typically scarce. The high protein content of Moringa has been cited as a potential tool for use in the fight against malnutrition, especially in developing countries.

The use of proteins from plant-sourced foods has gained significance since the majority of communities in developing countries are unable to afford animal-sourced proteins. The high prevalence of malnutrition in resource-poor countries has been blamed on feeding young children with monotonous cereal-based complementary foods that have low nutrient density. Despite this enormous nutritional potential, there is limited utilisation of Moringa in diets. In order to improve the utilisation of this plant, this study explored Moringa applicability in the formulation of complementary foods.

Objectives

The main objective of the study was to explore ways through which Moringa leaves can be used in enriching locally produced complementary foods of children below five years. The specific objectives were:

- 1) To document and characterise the varieties of *Moringa oleifera* leaves available in Uganda and how they are being utilised by local communities in Uganda.
- 2) To determine optimum conditions and methods through which *Moringa oleifera* leaves can be processed to obtain a suitable product to be used in enriching complementary foods.
- 3) To develop a complementary product suitable for children 6-59 months using *Moringa oleifera* leaves and other locally available foods.

Methodology

In order to document the growing patterns of Moringa trees and their utilisation by local communities, a cross-sectional survey was conducted in Mukono and Masindi districts using a structured questionnaire. The optimum conditions for the processing of *Moringa oleifera* leaves were conducted using different simple processing techniques such as drying using the sun or solar drier, boiling, fermentation and pickling, optimum conditions at which processing of *Moringa oleifera* leaves ensured retention of optimum nutrients. Physio-chemical characteristics of the products were determined and the various processing conditions compared.

The dried leaves were used in the formulation of a complementary product suitable for children 6 to 59 months. Proximate analysis was done for the complimentary food product using AOAC methods while sensory acceptability was performed using a 9-point hedonic scale. Data were analysed using SPSS and GenStat 4.10.3. Analysis of Variance (ANOVA) was used to determine the differences between samples and the Duncan Multiple Range Tests was used to test the level of significance between different sample treatments. A p-value of less than equal to 0.05 ($p \leq 0.05$) was considered statistically significant.

Key Research Outputs

Submitted manuscripts

Two manuscripts submitted to the *Journal of Food Science and Nutrition* are currently under review. These are:

- 1) Processing and use of *Moringa oleifera* leaves as human food and ingredient: A review (<https://mc.manuscriptcentral.com/foodsciencenutrition>)

- 2) Utilisation of *Moringa oleifera* leaves in the production of soy bean-maise porridge complementary food for children below five years

Innovations Arising from the Project

In addition, the study produced an innovative complementary product suitable for children below five years. This product will be patented.

Impact to the Society, University and Research Community

The study has immensely contributed to the body of knowledge as far as improvement of diets for the vulnerable members of the community are concerned. The study has provided a framework through which communities can utilise moringa leaves to improve the nutrition status of young children. Once published, the research will contribute to the visibility of the university.

Challenges and Lessons Learnt

The initial steps were hampered by long procurement processes while the latter part of the projected was heavily impacted upon by the COVID-19 pandemic. The major lesson learnt is that there are many underutilised plants out there that can be used to positively influence the food and nutrition situation of developing countries.

The Capacity of *Moringa oleifera* Leaf-extract to Improve Glycemic Control of Type 2 Diabetes

Project Team



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Introduction

Diabetes mellitus is a metabolic disorder affecting people in both developed and underdeveloped countries. It continues to be a global public health problem, with 422 million individuals affected in 2014. It mainly affects middle and low-income countries. In Uganda, diabetes mellitus prevalence is at 2.8%. Diabetes has no cure, yet the available treatment is for a lifetime, expensive and has serious complications after prolonged use.

There is growing interest to develop drugs from plant materials. *Moringa oleifera*, which is native to the sub-Himalayan tracts of Asia, is such a plant. In Uganda, rural communities use the leaves of *M. oleifera* to treat 24 ailments, including diabetes mellitus. There is evidence that it has hypoglycemic activity in diabetic rats. It works via its antioxidant properties on the liver and pancreas, plus an increase in β -cell mass and insulin production by the β -cells.

Objectives

- 1) Determine the effect of *M. oleifera* leaf extracts on blood sugar levels in alloxan-induced diabetic rats;
- 2) Determine the protective and reversal effects of N-Acetyl Cysteine on *Moringa oleifera* leaves induced sub-acute hepatotoxicity in Wister Albino rats;

- 3) Determine the safety of *M. oleifera* leaf aqueous extract on healthy adult human volunteers; and
- 4) Determine the efficacy and safety of *M. oleifera* aqueous extract on diabetic patients.

Methodology

Study Design: It was an experimental design for pre-clinical studies in laboratory animals.

Experiment 1. Determined the effect of *M. oleifera* leaf extracts on blood sugar levels in alloxan-induced diabetic rats.

Experiment 2. Determined the protective and reversal effects of N-Acetyl Cysteine on *M. oleifera* leaves induced sub-acute hepatotoxicity in Wistar Albino rats.

Experiment 3. Compared the hyperglycaemic control of *M. oleifera* leaves extract, Glibenclamide, Metformin and Pioglitazone tablets in alloxan monohydrate induced diabetic rats.

Clinical trial phase 1. It will establish the safety and tolerance of *M. oleifera* extract in healthy volunteers. This will be carried out at Makerere University Hospital. Participants will be healthy volunteers, aged 18-30 years. They will receive the investigation product for ten days and will be monitored using liver and kidney function tests.

Results

Results from the experiments showed that:

- 1) *M. oleifera* leaf extract has hypoglycaemic activity in diabetic rats
- 2) N-cysteine has a protective and reversal effects in *M. oleifera* leaf aqueous extract sub-acute induced hepatotoxicity in rats.
- 3) *M. oleifera* aqueous extract starts reducing blood sugar on day 1 and stabilises it by day 8 in alloxan monohydrate induced diabetic rats.
- 4) *M. oleifera* aqueous extract has the same trend as the tablet Glibenclamide in reducing blood sugar in alloxan monohydrate induced diabetic rats.
- 5) *M. oleifera* aqueous extract has better effects on reducing blood sugar than Pioglitazone tablet in alloxan monohydrate induced diabetic rats.
- 6) However, Pioglitazone tablet had better effects on reducing blood sugar than distilled water in alloxan monohydrate induced diabetic rats.

o Conclusion

- 1) *M. oleifera* aqueous extract has hypoglycaemic effects comparable to oral hypoglycaemic drugs on the market in diabetic rats.

- 2) *M. oleifera* aqueous extract continues to control blood for at least a week after stopping treatment. It may be having a long activity effect in diabetic rats.
- 3) *M. oleifera* aqueous extract is a promising drug to manage diabetes mellitus in diabetic rats.

Key Research Outputs

○ Publications

- 1) Namaganda, A., Kasolo, J. N., Bbosa, G. S., Lukande, R., Kimuli, I., Katamba, G., Muwonge, H., Okullo, I., Nfambi, J. (2020). Protective Effect of N-Acetyl Cysteine on *Moringa Oleifera* Aqueous Leaf Extract-Induced Hepatic Toxicity in Wistar Albino Rats. *Asian Journal of Pharmaceutical Research and Development*, 8(3), 34-39. DOI: <http://dx.doi.org/10.22270/ajprd.v8i3.749>
- 2) Kasolo, J. N., Namaganda, A., Bbosa, G. S., Muwonge, H., Lukande, R., Nfambi, J., Kimuli, I. & Okullo, I. (2019). Reversal Effects of N-Acetyl Cysteine on *Moringa oleifera* Leaves-Induced SubAcute Hepatotoxicity in Wistar Albino Rats. *Neuroscience & Medicine*, 10, 385-397. DOI: <https://doi.org/10.4236/nm.2019.104028>
- 3) Kasolo, J. N., Namaganda, A., Nfambi, J., Kimuli, I., Muwonge, H., & Okullo, I. (2019). Comparison of the Hyperglycaemic Control of *M. oleifera* Leaves Aqueous Extract and Glibenclamide Tablets in Alloxan Monohydrate Induced Diabetic Rats. *Asian Journal of Research in Medical and Pharmaceutical Sciences*, 7(1), 1-9.

Challenges and Lessons Learnt

- 1) Delayed clinical trial phase 1 approval at IRB, NCST especially this being the first study in Uganda to develop a drug from a herb.
- 2) Clinical trials are very expensive research undertakings.
- 3) The safe and effective treatment for diabetes can be developed from medicinal plants.

Persistent Organic Pollutants in Breast Milk, Blood and Placental Tissues for Mothers Living in the Urban and Rural Areas of Uganda

Project Team



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- **Graduate Student:** Teddy Nantume
- **Mentor:** John Wasswa

Introduction

Over the last two decades, most urban areas in Uganda have experienced rapid industrialisation and urbanisation. These developments, coupled with the importation of consumer goods such as old electrical and electronic waste (e-waste) in the name of “recycling” from developed countries, are creating new sources of pollutants. Some of the chemicals that are released from the aforementioned sources are persistent organic pollutants such as polybrominated diphenyl ethers (PBDEs) and related chemicals. The pollutants have been implicated in a broad range of adverse effects such as endocrine disruption and neurodevelopmental deficits.

Owing to the growing level of industrialisation in Uganda, we hypothesised that industrial activities and e-waste recycling were exposing the mothers especially those in Kampala and Jinja districts to PBDEs, which could have deleterious effects on their breastfeeding infants. However, the in-utero exposure levels and profiles of PBDEs in Uganda remain unknown. Furthermore, no data was available about the health risks posed to nursing infants through the consumption of the contaminated milk.

Objectives

The overall goal of the project was to establish prevalence data of PBDEs in biological samples (breast milk, cord blood and placenta) and to evaluate the likely health risk posed by PBDEs on the breastfeeding Ugandan infants. The specific objectives were to:

- 1) determine the PBDEs in breast milk, cord blood and placenta samples from mother-infant pairs living in Kampala and Jinja districts (urban and industrial areas) and, Nakaseke and Rukungiri Districts (rural areas); and
- 2) evaluate the socio-demographic characteristics of the participants and dietary determinants of maternal PBDE concentrations.

○ **Methodology**

The study areas were Kampala and Jinja districts (industrial and urban areas) and the rural areas of Nakaseke and Rukungiri districts for comparison purposes. We first evaluated the transfer of PBDEs from mother to foetus and the determinants of maternal PBDE exposure during and after pregnancy. Breast milk, cord blood and placenta samples were extracted by dispersive solid-phase extraction (SPE), liquid-liquid extraction and sonication, respectively. Clean-up of extracts was performed on an SPE column, and analysis was done using gas chromatography-mass spectrometry. The determinants of exposure were determined using a structured questionnaire containing information about the daily dietary food consumption and demographic characteristics of the mother (age, educational level, gestational age, place of residence, pre-pregnancy weight, pre-pregnancy height, work history) and those of the infants (weight, length and head circumference at the time of birth).

Key Research Outputs

Publications

The outputs of the project include:

- 1) five peer-reviewed journal articles (Science of The Total Environment (2020): 739, 139913; Environmental Pollution (2020): 258, 113723; Science of the Total Environment (2019): 692, 1106-1115; Chemosphere (2019) 223, 483-493; Science of the Total Environment (2019): 695, 133789);
- 2) four submitted journal articles;
- 3) four conference papers;
- 4) four master's dissertations (Ms Teddy Nantume, Mr Daniel Omoding, Mr Juma John Moses Abayi, Mr Fred Sepuya); and
- 5) one policy brief.

Impact to the Society, University and Research Community

- 1) We repaired fume hoods in the Department of Chemistry, Makerere University, at the cost of USD 2000.
- 2) A departmental workshop was organised to disseminate research findings to members of staff and graduate students.
- 3) Two dissemination workshops involving civil society, physicians and district leaders/policymakers were organised in Rukungiri District and Iganga District to influence policy.

Challenges and Lessons Learnt

IRB approval and procurement of chemicals and equipment delayed project implementation.

The training has helped the research team network with experts in Environmental Chemistry and Toxicology from Africa and other continents. Furthermore, the training has helped the team understand the trends in global Science and Technology, and the available opportunities for North-South and South-South Cooperation, particularly in Environmental Chemistry and Toxicology. Patrick Ssebugere (PI) was recently awarded grants by the Third World Academy of Sciences (TWAS) and Erasmus+ programme.

Enhancing Customer Relationship Management in Institutions of Higher Learning with the Aid of Information and Communication Technologies: A Case of Makerere University

Project Team



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Introduction

The emergence of new competitive forces within higher education institutions (HEIs) such as: frequent innovations in teaching/learning, increase in the number of private universities, decrease in state funding for public universities, low student retention rates and the idea of the student as a customer, have contributed to the emergence of Customer Relationship Management (CRM) as a key management function the university should adopt. Customer Relationship Management is a process that enables institutions to provide excellent real-time customer service by developing a relationship with each valued student through the effective use of individual account information (Kotler & Keller, 2006).

Makerere university introduced ARIS and FINIS software as a way of serving students better. However, these systems have restricted access and little to offer to students who are demanding more attention, excellent real-time and personalised customer service from the university.

Objectives

It is against this background that the project sought to:

- 1) Investigation CRM approaches to student services.
- 2) Establish the level of adoption of ICTs in CRM approaches to student services.
- 3) Propose a framework for successful integration of ICTs in CRM approaches to student services.

Methodology

The study took an action research approach employing mixed methods. Before embarking on data collection, ethical clearance was obtained from the relevant ethics committees. Data was collected from (10) registrars and (10) programme coordinators who were purposively selected, and (380) students who were randomly selected from the nine colleges and one school. From each college, 38 students were interviewed. Quantitative data was collected using questionnaires and analysed using SPSS, while qualitative data was collected using focus group discussion and interviews with key informants and analysed using Atlas.ti. In order to recommend best practices in CRM at Makerere University, other public universities were benchmarked.

Key Research Outputs

○ Publications

- 1) Mayanja, J., Tibaingana, A., & Birevu, P. M. (2019). Promoting Student Support in Open and Distance Learning Using Information and Communication Technologies. *Journal of Learning for Development*, 6(2), 177-186. Available at: <https://jl4d.org/index.php/ejl4d/article/view/360/406>
- 2) Mayanja, J., & Tibaingana, A. (2020). Customer Relationship Management Perception among Students of Higher Institutions in Uganda. *A Journal of Contemporary Research*, 17(2), 86-106. Available at: <https://www.ajol.info/index.php/lwati/article/view/196187>
- 3) Osinde, C., Mayanja, J., & Tibaingana, A. (2020). Technology Service Quality and Customer Satisfaction in Uganda's Banking Sector. *Technology*, 1, 4. Retrieved from <http://www.ijtef.org/index.php?m=content&c=index&a=show&catid=109&id=1043>

Submitted manuscripts

Mayanja, J., Tibaingana, A., & Muyinda, P. B. (upcoming). A SERVQUAL-based framework for assessing the quality of technology-enabled students' support services in open and distance Learning at Makerere University: A students' perspective. (This is a book chapter to be published by Makerere University Press)

in a book entitled *Emerging technologies to promote inclusive, quality and equitable education*.

Innovations Arising from the Project

A scholarly writing workshop focusing on providing academic staff with skills to write articles, books, grant proposals and conference proposals was conducted. All the participants produced book chapters to be published in a book under the theme "*Emerging Open Distance and eLearning (ODEL) technologies to promote inclusive, quality and equitable education*".

Impact to the Society, University and Research Community

- 1) A workshop was held for staff in the College of Education and External Studies to disseminate project results.
- 2) The student graduated with a Master's in Business Administration on Wednesday, January 15, 2020.
- 3) CRM has become very important for students' retention and loyalty. Enhancing CRM with ICTs will allow the university to have a clear and complete picture of each student's unique situation to enable effective interaction and tailoring of services to student's characteristics and requirements, so as to reduce on the dropout rate.

Challenges and Lessons Learnt

Challenges

- 1) Getting ethical clearance from the relevant ethical committee takes a lot of time.
- 2) Data could only be collected when the university is in session, and students are around.
- 3) The project was carried out alongside teaching activities, which affected some deadline.
- 4) Respondents (registrar and program coordinators) being busy on the agreed appointment time, leading the project team to reschedule appointments or interviews.

Lessons Learnt

- 1) Preliminary project plan and schedule were well documented with appropriate structure and detail. Changes in the plan that did occur were of manageable frequency and magnitude and were approved by all team members.
- 2) Project roles and responsibilities were adequately defined and prepared by the team member. Keeping teams on the same page made things happen interactively.

- 3) Working closely with the registrars and programme coordinators helped to build confidence and cooperation. They shared the required information and documents after sharing with them the project plan and schedule.

An Assessment of the Implementation Strategies of Mother Tongue Education in Uganda: A Case of Northern Uganda

Project Team



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- **Co-PI:** Allen Asimwe
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- **Mentor:** Susan Kiguli

Introduction

The government of Uganda formulated a policy that promotes the practice of mother tongue education. The language-in-education policy stipulates that rural schools select a dominant local language to be used as a Language of Learning and Teaching (LoLT) from P1 through P3, with P4 then being a transitional year in which there is minimal use of MT as learners are being prepared to transition to English, which is the LoLT from P5 through P7. Urban schools, presumed by the policy to be “too multilingual” choose one mother tongue to be taught as a subject, and use English as a LoLT (Government of Uganda, 1992; Ministry of Education and Sports, 2008).

The success and acceptance of MT education in Uganda is has been reported to be at differing levels. On the one hand, from the available literature (Heugh & Mulumba, 2013; Heugh & Namyalo, 2017; Ssentanda, 2014), the northern part of Uganda is relatively successful in the implementation of the MT education policy. For example, Heugh and Mulumba (2013, p. ix) point out one of the indicators of success for MT education as “[i]ncreased community and parental awareness of the value of local languages in education.” On the other hand, Ssentanda (2013) and Tembe and Norton (2011) have reported how the community in Central and Eastern Uganda respectively is indifferent about the use of MTs in the education of their children.

Given that Northern Uganda has experienced political turmoil for close to 30 years, the major question, therefore, is why this part of Uganda appears to be doing better in MT education than the rest of the country which has had relative political stability. The project, therefore, set out to investigate the circumstances under which the northern part of Uganda implements the mother tongue education programme, i.e., why northern Uganda is reported to be doing better in terms of mother tongue education acceptance and/or implementation.

Objectives

- 1) To assess the resources and facilities available for MT education in Northern Uganda.
- 2) To draw language diversity profiles of schools, classrooms and individual teachers in this study in order to obtain a sense of multilingualism in northern Uganda and determine whether such language profiles are a reason for the success of MT education in the region.
- 3) To describe the classroom practices used by teachers to teach MT(s) in northern Uganda.
- 4) To assess teachers' perceptions (and other stakeholders) of what contributes to success or failure in implementing MT education.
- 5) To draw lessons for the rest of the country in the implementation of MT education.

Methodology

- 1) Classroom observations.
- 2) Follow-up interviews with teachers and NGO personnel.

Key Research Outputs

Publications

Ssentanda, M., & Asiimwe, A. (2020). Challenges to the Acquisition of Literacy in Rural Primary Schools in Northern Uganda. *Language Matters*, 51(1), 38-62.

Available at:

<https://www.tandfonline.com/doi/abs/10.1080/10228195.2020.1717587>

Submitted manuscripts

We submitted a journal article, *Teachers' views towards, and practices in the teaching of mother tongue in Uganda: an ethnographic view to Stellenbosch Papers in Linguistics Plus*.

We have received reviews for the article are working on the revisions. We hope the article will come out in 2021.

- **Policy briefs**

- 1) An article in *The Conversation* titled *How Uganda is failing to help rural children learn languages*. The article was published and can be accessed at this link: <https://theconversation.com/how-uganda-is-failing-to-help-rural-children-learn-languages-119403>
- 2) In addition, our publication was picked up by the NTV media house, and the PI was approached by NTV for comments on literacy issues. The broadcast was made on the International Teachers' Day, October 05, 2020. See this link: https://www.youtube.com/watch?v=_oVYNk0Ds9I

Innovations Arising from the Project

- 1) The project has found that the challenges faced in the implementation of the mother tongue programme in northern Uganda are not different from the rest of the country.
- 2) The involvement of parents and the community in the mother tongue education programme in northern Uganda is considered better.
- 3) Creation of awareness of the challenges faced by learners and teachers in the process of literacy acquisition through the mother tongue education programme.
- 4) Contribution to the fund of knowledge around mother tongue education in multilingual contexts.
- 5) Facilitated research-related training in the Department amongst staff and MA students.
- 6) Contributed to the research output of the university.

Adult Learning for Socio-economic Transformation: Perspectives from Uganda

Project Team



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- **Mentor:** Anne Ruhweza Katahoire

Introduction

Adult Learning and Education (ALE) as a discipline has been fluid in terms of conceptualisation and practice, and every country has had its unique experience. Not only has the conceptualisation led to confusion among the public but even among professionals and/or practitioners. This has ultimately negatively impacted on its growth, professionalisation, public perception and role in socioeconomic development in the country. Literature asserts that ALE is not a discipline like law or economics but rather 'life' in itself. Hence ALE is viewed as an inherent human endeavour to live better.

This paper traces the efforts in the growth and development of ALE in Uganda over time highlighting the unique journey to claim its place among disciplines and professional fields. Data was collected using document review, interview guides and focus group discussions with stakeholders. The interest was on how they came to associate with the discipline, public and practitioner perceptions, perceived contribution in socioeconomic transformation and where they see the discipline in the years to come.

Through logic analysis, a number of themes emerged to describe the state of ALE in Uganda. These included: 'no place to call home', 'disjointed efforts', 'one step forward, two steps backwards', and 'in it together'. Findings reveal remarkable efforts amidst contradictions, confusion in terminology and the challenges in the understanding and practice of ALE.

The paper ends with recommendations to actors to streamline the discipline through benchmarking, investment in research, coordination and advocacy. We further recommend engagement with government and stakeholders to enact a policy for proper coordination of ALE efforts and standardisation. A lot of lamentations seem to ignore the fact that 'it starts with you and me'.

The Marketization of Public University Education in Uganda: Implications for Quality Assurance in the Governance of the Teaching and Learning Processes

Project Team



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- **Graduate Student:** Baine Albert
- **Mentor:** Betty Ezati

Introduction

The study explored and sought to understand the implications of marketisation on quality assurance in the governance of the teaching, learning and assessment processes of two public universities.

Objectives

The objectives of the study were to:

- 1) Identify the existing policy frameworks governing quality assurance in teaching, learning and assessment processes in public universities.
- 2) Analyse implementation of existing quality assurance policies in teaching, learning and assessment processes light of widened participation, diminishing resources and a marketised higher education environment.
- 3) Identify the gaps within the existing quality assurance policies.
- 4) Identify the challenges hindering quality assurance in the teaching, learning and assessment processes in public universities.

Methodology

The research design was a comparative study of two purposively selected public universities which are secular and are the oldest public universities in Uganda.

Information was obtained through key informant interviews, focus group discussions, documentary review and observation of naturally occurring events where possible. Participants were selected from those who are regularly engaged in the teaching and learning processes. These included deans, heads of department, programme coordinators and top managers.

Interview data was recorded and transcribed, and analysis was through thematic content analysis, clustered according to the objectives of the study.

Key Research Outputs

Publications

The PI has co-published two journal articles and one book chapter is in the process of being printed as indicated below:

- 1) **Mugisha Baine E. M.** et al. (2019). Internationalisation and the global citizenship of university graduate students. *Education Quarterly Reviews*, Asian Institute of Research, pp 551-563. Link: asianinstituteofresearch.org
- 2) **Mugisha Baine E. M.** et al. (2020). Economic struggles, resilience and agency: ageing market women redefining 'old' in Kampala, Uganda. *Gender and Research*, 21(1).
https://www.researchgate.net/publication/343942451_Economic_Struggles_R
- 3) **Mugisha Baine E. M.** forthcoming, 'Gender mainstreaming strategy for promotion of gender equality: Gains and Challenges in Uganda's higher education' in *Gender and Development*, Fountain Publishers, Kampala.

Submitted manuscripts

Two manuscripts have been prepared. Their abstracts have been submitted under a book project being implemented by the East African School for Higher Education and Development in partnership with the University of Otago, New Zealand. Feedback is due by the end of October 2020 and Manuscripts for the accepted abstracts are due on January 15 2021. Please visit the following link for details. <https://blogs.otago.ac.nz/hedc-telt/2020/08/11/book-highered-in-sub-saharan-africa/>

Policy briefs

- 1) I have participated in the review of the Policy and regulations against Sexual Harassment and the reviewed Policy was passed on December 05 2018
- 2) I have participated in the review of the Makerere University gender Equality policy 2009 and the proposal for review are before the University Council for Consideration.

Innovations Arising from the Project

If at least one of the two abstracts and manuscripts are accepted and published, I will be eligible to apply for the position of Associate Professor of Higher Education of Makerere University.

Impact to the Society, University and Research Community

- 1) One of the issues affecting quality learning and assessment is the problem of sexual harassment. The GMD run sensitisation seminars for Deans, Heads of Department, programme coordinators on sexual harassment prevention and how to respond if and when it happens.
- 2) The project run seminars on how to conduct gender-responsive research for staff and PhD students of the East African School for Higher Education Studies and Development.

Challenges and Lessons Learnt

- 1) The PI was happy to be appointed the Director GMD but this also put a major strain on the speed of the implementation of the project.
- 2) The Co-PI Dr Resty Naiga, Lecturer, Department of Development Studies, Makerere University obtained another research grant and left the project in early 2019.