CONFERENCE Theme: “Food and nutrition safety from farm to fork: a missing link in consumer health and food security”

Book of Abstracts and Conference Programme

Venue: Kenyatta University, NAIROBI, KENYA  Dates: 20th to 24th May, 2019

Edited by Dr. Ann Munyaka and Dr. Juliana Kiio
PARTNERS AND SPONSORS
Kenyatta university welcomes the guests and participants to the May 20th to 24th 2019 International Food Safety Conference whose theme is: “Food and Nutrition Safety from Farm to Fork: A Missing Link in Consumer Health and Food Security”. The Conference has come at an opportune time when the world is set to celebrate the maiden World Food Safety Day on 7th June 2019, as proclaimed by a United Nations General Assembly resolution in December 2018.

The vision of Kenyatta University is to be a dynamic, inclusive and competitive Centre of excellence in teaching, learning, research and service to humanity. Research and dissemination of research findings is one of the University’s core mandates. As a dynamic institution, Kenyatta University has endeavored to remain in touch with issues affecting human welfare both locally and internationally. At the national level, the University is supportive of the Government’s big four agenda on Housing, Food Security, Universal Health Coverage, and Manufacturing. It is in this context that we have partnered with key players in the food industry to host this International Food Safety Conference.

I am sure that the conference will generate impactful insights into the important subject of food safety and factors that hinder a significant section of the global populace from enjoying the myriad benefits of safe food, and also set the pace for future research and policy endeavors to tackle the challenges of unsafe food.

Once again, you are all most welcome to Kenyatta University and Kenya. While you are here, take time to tour our vast campus and savor its serene atmosphere and landmarks, and to visit Nairobi, “the City in the Sun”, which is the regional economic hub.

PROF. PAUL K. WAINAINA, Ph.D.
VICE CHANCELLOR, KENYATTA UNIVERSITY
MESSAGE FROM THE CHAIR, LOCAL ORGANIZING COMMITTEE

Dr. Dorcus Mbithe D. Kigaru
Chairperson, Conference Organizing Committee and
Chairperson, Department of Food, Nutrition and dietetics,
Kenyatta University

The global food security situation has been shaken by the many emerging and re-emerging issues of food safety concern. At national level there is multiple concerns of food safety, famine and effects of climate change. Unsafe food creates a vicious cycle of disease and malnutrition which ultimately affect national development. Generally the poor and the rich are exposed to unsafe food. Food safety is a multi-sectoral issue that requires multi-stakeholder approaches to find solutions. Discussions during this Food Safety Conference can be harnessed to solve real problems affecting key actors and consumers at different levels.

I sincerely thank the organizing committee that worked devotedly to realize this conference. Your commitment and desire to see the Conference succeed was exceptional. I wish to thank the respective academic Departments and Deans of Schools for their support. The guidance by the Directorate of Research Support, Kenyatta University is appreciated. The Registrar Corporate Affairs, Kenyatta University is thanked for her continued support and encouragement. To the Vice Chancellor, Kenyatta University, thank you for your immense support in ensuring this Conference succeed.

Many thanks go to the Ministry of Agriculture and Ministry of Health focal persons who helped the organizing committee publicize this conference. I also thank the leadership of government parastatals and research organizations for supporting this conference and accepting to deliver key note speeches. The focal person of the Kenya Scaling Up Nutrition (SUN) movement is thanked for her assistance in mobilizing the five SUN networks in Kenya to participate and support this conference. These networks include the Government ministries and Counties, the UN, the business network, the academia and research institutions and the civil society network. I also wish to thank the international advisors who supported the need to have stronger food and nutrition associations in Kenya.

I wish to thank all the international and national key note speakers for accepting to come and deliver key note addresses that shape the conference discussions. I thank our sponsors who chose, in different ways, to support this conference and make it a success. I also sincerely thank those individuals who continually prayed for the organization and success of this conference.

To all participants, Thank you.
KEY NOTE SPEAKERS

PROF. HAMADI IDDIBOGA, PHD
PS AGRICULTURE RESEARCH, MINISTRY OF AGRICULTURE AND IRRIGATION

Born 03.12.1967 in Kwale Kenya, Prof. Hamadi Iddi Boga, is the Principal Secretary State Department for Agricultural Research and Acting Principal Secretary, State Department for Crop Development. He was a Professor of Microbiology at Jomo Kenyatta University of Agriculture and Technology (JKUAT) was the Acting Vice Chancellor of Taita Taveta University since 7th October 2016. He has a BSc in Botany and Zoology (First Class Honors) and MSc in Botany (Microbiology) from Kenyatta University in Kenya, PhD in Microbial Ecology and Microbiology from University of Konstanz, Germany and a Post-Doctoral Research stay at the Max Planck Institute for Terrestrial Microbiology in Marburg, Germany.

He is also a Humboldt Fellow and was from 2010-2015 the Humboldt Ambassador Scientist for Kenya. Boga has previously, held various administrative positions in JKUAT including Chairman of Botany Department (2002-2004), Director of Institute of Biotechnology Research (2005), Dean of Faculty of Science (2007) and Principal of JKUAT Taita Taveta Campus in Voi (2007 to 2012). From 2012-2016 he was the Principal of Taita Taveta University College.

He has an extensive international and local network of scientific engagements and collaborations. He was a Board Member of the World Federation of Culture Collections (www.wfcc.org)(2010-2013). He was the Secretary of the African German Network of Excellence in Science (AGNES) (2013-2016), the Secretary (2002-2006) and later Chairman (2008-2010) of the Kenya German Scholars Association (KDSA)

Boga has over 66 scientific publications in International Journals, has supervised over 14 PhD and 31 MSc students. He is an active researcher with active international collaborations. Has a strong track record of fundraising for research. He has wide experience in Management and strategic planning.

Professor Francis Bruno Zotor is a Professor of Public Health Nutrition at the School of Public Health. He is also Director, Office of International Programmes University of Health and Allied Sciences, Ghana. He has a doctoral training in public health nutrition, is a registered public health nutritionist with the Association for Nutrition of the UK and Northern Ireland and a specialized training in pedagogy with a Fellowship of the Higher Education Academy of the UK and Ireland. He is a recognized leader spanning over two decades in nutrition across Africa and has been instrumental in driving and promoting the establishment of a strong nutrition profession on the continent, training and research to underpin programme delivery especially across the health and education sectors in Africa.

Prof Zotor’s global context of his work has enabled him to work in both developed and developing societies. He serves on a number of international boards (in Africa, as Trustees of the African Nutrition Society and the Federation of African Nutrition Societies; at the global level as member of the United Nation’s Scaling Up Nutrition Civil Society Network). Currently, he serves on Council of the International Union of Nutritional Sciences (IUNS), a body that oversees the strategic directions of nutrition across the globe.

David Morgan,
Senior Technical Specialist, Quality & Safety
Global Alliance for Improved Nutrition (GAIN)

A qualified food technologist with over thirty years’ experience in the food sector, David has worked extensively in the areas of quality assurance, product development and technical management and with a wide range of food products and process types. His core skills include the management of food safety through HACCP, implementation and assessment of
Quality Management Systems for food production and technical auditing against quality standards. David has worked in these capacities within a range of food processors, manufacturing food products with ambient (canned, pasteurized, dried, preserved) storage as well as low-temperature storage requirements (frozen and short-shelf-life chilled, pasteurized).

He has worked in the international development sector for the last ten years with experience across Sub-Saharan Africa and South Asia. He has worked with GAIN since 2014 and has a key involvement with the GAIN Platform for Quality & Safety (including the GAIN Premix Facility) in a technical capacity, overseeing quality and safety of micronutrients that are procured and supplied to global programs. David also provides technical assistance and advice to a number of GAIN’s programs, focusing primarily on food quality and safety.

Dr. Indraph Ragwa is the current Chief Executive Officer of the Kenya Veterinary Board a position he has held for the last three years. He is in charge of coordinating the Board’s regulatory activities which include ascertaining compliance with the set veterinary standards in veterinary practices and animal health training institutions; provision of continuous development activities for veterinary practitioners and overseeing their professional conduct in accordance with the Veterinary Surgeons and Veterinary Para-professionals Act, laws of Kenya. The objective is to safeguard animal health and safety, promote human health and ensure protection of the economic interest of the public thus contributing to the country’s development agenda.

Previously he served as the Chief Veterinary Inspector in the same organisation where he was actively involved in inspection to ascertain compliance with the Act and enforcing the same. As a veterinary surgeon for the last 35 years he has served in six different counties that include Kisii, Lamu, Mombasa, Meru, Isiolo and TharakaNithi in various capacities ranging from being in charge of veterinary services in a division and finally in the district employed by the ministry in charge of Livestock Development in Kenya. Dr. Ragwa holds a Master of Arts (Project Planning and Management) and a Bachelor of Veterinary Medicine both from the University of Nairobi. Besides he has undertaken several short courses inter alia Corporate Governance; Senior Management; Participatory Rural Appraisal; Project planning and Management; Group Dynamics; Monitoring and Information Systems; Environmental Impact Assessment and Audit; Performance Management; Veterinary Practice Management; Post Marketing Surveillance of Veterinary Medicinal Products and Rinderpest Diagnosis.

Prof. Judith Kimiywe is an Associate Professor and a Certified Nutrition Specialist in the Department of Food, Nutrition and Dietetics at Kenyatta University. Her main goal is to bring about transformation change in livelihoods through translating nutritional science into sustainable action. Her research has centered on use of locally available resources and support systems to enhance food and nutrition security of individuals and communities to mitigate hunger, malnutrition and poverty in Kenya and beyond. She has worked as a consultant for various international and UN agencies on development programs for informing policy for Kenya, Regional and internationally, and has made a significant contribution to formulation of country policies, strategic plans and guidelines for addressing nutrition of vulnerable populations. She has published and disseminated her works widely. Prof. Kimiywe is a member of several professional organization including Africa Nutrition Society, Federation of Africa nutrition societies, Kenya coalition of Action for Nutrition, Nutrition Society among others. Appointed as an Expert Consultant – Joint FAO/ Bioversity International Expert Consultation on Nutrition Indicators for Biodiversity – 2 Food Consumption Washington DC, 8 – 9 June 2009. She is an awardee of the CGIAR Award to dietary diversity Kenya Team, awarded the Vice Chancellor’s Award in recognition of attracting high number of research grants and best performing lecturer. Nominated Custodian of Dietary Diversity by Biodiversity International and has been nominated as Kenyan delegate to various high level global forums.
Dr. Eliud Kiplimo Kireger is the Director General/CEO of Kenya Agricultural & Livestock Research Organization (KALRO). Prior to this appointment, he served as the Managing Director/CEO of the Tea Research Foundation of Kenya. Dr. Kireger attained his PhD in Plant Eco-physiology from the University of Wales, (UK), MSc in Genetics and Tree breeding from University of Toronto (Canada) and a BSc in Forestry from Moi University (Kenya). He has trained in Conflict Management and Resolution, Strategic Leadership, Company Directorship and Change Management among others. He was an Appointed Member of the board of management of Kenya Agricultural Research Institute (KARI) where he chaired the Audit committee. He served as Senior Lecturer and Dean School of Natural Resources and Environmental Management at Kabianga University College, a Constituent College of Moi University.

He has mentored many young scientists and supervised many graduate research projects at BSc, MSc and PhD levels at both Moi University and Kabianga University College. Previously, he also worked with Kenya Forestry Research Institute as Research officer and Deputy Project Manager at the Japan International Corporation Agency Social Forestry Training Project in Kitui.

Dr. Kireger received an Australian International Development Agency award to train for a Certificate in Change Management Projects for Poverty Reduction through Action Learning and Research Methodology at the University of Stellenbosch (South Africa) in 2007; Association of Commonwealth Universities, Doctoral Research Fellowship, at the University of Wales (UK) in 1999; International Centre for Research in Agroforestry award for training in Agroforestry Research, Nairobi, Kenya in 1995; International Development Research Centre, Research Fellowship towards M.Sc. Thesis, University of Toronto, Canada in 1989; Japan International Cooperation Agency, for training in Social Forestry Management at Kanto Forest Tree Breeding Station (Japan) in 1988. Dr. Kireger has published widely in refereed journals, book chapters, books, conference/workshop papers, working documents, and many others. He is a member of the African Forest Forum, Kenya Forestry Society, the Agricultural Society of Kenya and the Ecological Society of Eastern Africa.

Prof. Charles Muyanja holds a PhD, Food Science (Food Microbiology and Biotechnology) and MSc Meat and Fish Technology, University of Life Sciences, Norway. Currently is a full professor at the Department of Food Technology and Nutrition, Makerere University. He has an outstanding expertise in Food Technology, Food safety, Cluster and innovation systems, designing, planning and facilitating learning process, Personal Mastery and soft skills. He has enhances his career in various disciplines from various institutions in USA, Sweden, Netherlands, Israel, New-Zealand, South Africa, Mozambique and Uganda. He was first sitting President of African Association of Food Protection (AAFP), affiliated with International Association for Food Protection (IAFP) (USA) aiming at making food safe worldwide. Currently, he is the treasurer for the renamed association: African Continental Association or Food Protection (https://www.acafoodprotection.org) still an affiliate of International Association of Food Protection (https://www.foodprotection.org). He has a 25 year of experience in teaching, research and consultancy, working area of food, food safety, food value chain and nutrition. He has researched on food safety of street vended and fermented foods. He published several papers in reputable scientific journal, co-authored book chapters and presented several papers in both regional and international fora. Muyanja's current efforts are concentrated on the dissemination of food safety knowledge, developing food safety policies and technically supporting industries to meet the required food safety standards for purposes of certification and supporting trade. He is a good advocate of HACCP application in small scale food processing industries and consumer protection.
Dr. Paul Wangai Jr is a Registered Nutritionist and Consultant Physician at Aga Khan University hospital Nairobi. He is also an Adjunct Professor, University of Lusaka, Zambia. He has authored 146 publications with an avid interest and research in Nutrition and degenerative diseases of modernity.

Prof. Bruno De Meulenaer
Working address: Vakgroep Voedselveiligheid en Voedselkwaliteit, Universiteit Gent; Coupure Links 653, 9000 Gent; tel 09.264.61.66; telefax 09.264.62.15, Belgium
email:- Bruno.DeMeulenaer@UGent.be

Education
Bio-ir. Chemistry (1994) (M. Sc. Agricultural Engineering, Chemistry); PhD in Applied Biological Sciences, option chemistry (2002) (Chemical interactions between packaging materials and foodstuffs)

Career
- 01.10.2005 – present : professor in Food Chemistry and Chemical analysis of foods at the Department of Food Safety and Food Quality, Ghent University
- 01.11.1995 – 30.09.2005 : scientific researcher, assistant and doctor-assistant (post-doctoral researcher) in Food Chemistry and Chemical analysis of foods at the Department of Food Safety and Food Quality, Ghent University

Current research
The research covers chemical aspects of chemical food safety and food quality. With respect to food safety, focus is given to the formation of process contaminants in foods (e.g. acrylamide, furan), the behavior of allergic proteins, the production of mycotoxins and the migration from food contact materials. The research group also has a lot of experience with respect to risk assessment and exposure assessment of toxic compounds present in foods. With respect to food quality, especially the role of oxidation (of fats, proteins and vitamins) on the quality of foods is studied as well the role of packaging in preserving the chemical quality of foods.

Other professional activities include, organiser and coordinator of Intensive Training Program in Food Safety, Quality Assurance and Risk Analysis (VLIR ITP), coordinator of Pack4FOOD (www.PACK4FOOD.BE), Member of the Scientific Committee of the Belgian Federal Agency for the Safety of the Food Chain (FASFC), Member of the Superior Health Council, section Nutrition (advisory board for Federal Minister of Public Health), Associated editor Food Research International and member of the Royal Flemish Society of Engineers, the Royal Flemish Chemical Society and the American Chemical Society

Dr. Mokaya, a Director & CEO of Organic Consumers Alliance (OCA), is a Johns Hopkins Bloomberg School of Public (USA) & University of Nairobi Medical School trained Public Health Physician and a Health Development Practitioner with over 30 years of experience in the practice and management of healthcare with a focus on Preventive Health Care, Health Systems Strengthening, Community Health Development, Reproductive Health, Child Survival & Development, and HIV/AIDS, TB, Malaria and related policy and strategy imperatives.

He has related policy, strategy and implementation knowledge, skills and experience in a broad range of pertinent nutrition, health and safety issues within the broader context of an agro-ecology friendly and sustainable development agenda.
Dr. Moses Ndungu Mwangi is an alumnus of Alliance High School and holds a Bachelor of Pharmacy degree from the University of Nairobi and an MBA in Strategic Management from Moi University, Eldoret. He is a member of the Pharmaceutical Society of Kenya (PSK) and served several years as its national treasurer and various other council positions. In 2007, Dr Moses was honoured by the PSK for his exemplary service to the pharmacy profession. Dr Moses also served in the executive committee of the Kenya Association of Pharmaceutical Industry (KAPI) and was its chair between 2009 and March 2012. He was a founder board member of the Kenya Health Federation (KHF), the umbrella body that represents the health sector in the Kenya Private Sector Alliance (KEPSA). Moses served on the board of the Kenya Medical Supplies Authority (KEMSA) from August 2009 until August, 2012. As a manager in the medical profession, Moses devoted 24 years of his career to preventing diseases through training, promotion and advocacy for vaccines. He is a faithful student of Louis Pasteur who said, ‘to treat is good, to prevent is better’. For about 16 years until December 2012, Moses served as the Eastern Africa Regional Director of the world number 1 vaccines company, Sanofi Pasteur overseeing nine (9) countries. Thereafter, Dr Moses served as the Deputy CEO of The Karen Hospital, Nairobi for about year and then in 2015, Dr Moses took up his current position of CEO of the Fortified Foods Division of Equatorial Nut Processors Ltd (ENP) whose manufacturing facility is based in Maragua, Muranga County. ENP is the leading manufacturer of Corn Soya Blend (CSB) based, Fortified Blended Foods (FBF) in Eastern Africa. Dr Moses has participated in several international, regional and local trainings, seminars and conferences in diverse areas including Vaccinology, Infectious diseases, Corporate Governance, Leadership and Change Management. He is an astute Health professional with a distinguished record and immense managerial experience. Moses is involved in education matters having served in the Boards of Nginda Girls, Ichagaki Boys, Limuru Girls, and Bishop Mahia-ini Academy and as its chair, he oversaw the transformation of Kaharo Secondary school from a mixed school to two separate and vibrant institutions, Kaharo Girls and Kaharo boys respectively. For over 15 years, Moses has presided over the transformation of the KBA School to the KBA Group of Schools in Kahawa west and Maziwa estates, Kasarani sub-county Nairobi. The KBA Group is a highly successful enterprise greatly impacting, current and future generations and is the Education ministry of Kahawa West Baptist Church. He was among those who initiated Kaharo Health Centre in his rural home in Maragua Constituency and was one of the founders and chair of Friends of Maragua District Hospital which was instrumental in securing the land that enabled the hospital
to develop and expand its current infrastructure. Over the past 3 decades, Dr Moses has supported, mentored, and role-modeled many young people in Murang’a County and beyond. In 2004, H.E. President Mwai Kibaki honoured Dr. Moses Ndungu Mwangi with the Head of State Commendation (HSC) medal, in recognition of his contribution to the advancement of health care in Kenya. Moses, aged 57, is an active church Elder and for over 30 years has shared the Word of God in churches, schools, colleges and other places of worship, thereby, positively influencing the Kingdom of God. He is married with one wife and three adult children who are already progressing well in their careers.

Mrs. Beatrice Opiyo is the Manager in charge of Food Safety Certifications which include HACCP, ISO 22000 and FSSC 22000 at the Kenya Bureau of Standards (KEBS). She has worked at the Kenya Bureau of Standards for over 10 years, serving in different capacities in conformity assessment and Standardization. She has worked as a Quality Assurance Officer carrying out inspections and quality assurance in Food manufacturing establishments and has also served as the head of Technical Training and Advisory (the current NQI at KEBS). She is a registered lead trainer and auditor for ISO 22000 and ISO 9001 among other management system standards. She has a great passion for food safety and quality and a firm believer that any food business can achieve the highest quality and safety of their products by just beginning with implementation of basic food hygiene requirements.

Beatrice possesses hand-on experience in standards setting and implementation of internationally recognized food safety standards having supported several food establishments (both small and large) in Kenya, Tanzania, Uganda, Rwanda, Zambia, The Gambia, Sierra Leone, Liberia and South Sudan to implement food safety standards to be able to meet international food safety requirements for improved market access. She also has participates in development of international Standards having contributed in CODEX TC meetings and forums as well as ISO TC on Food safety for standard development in food safety matters. She has vast hands-on experience in quality assurance and food safety and has mentored and coached an unlimited number of Food safety experts and practitioners in Kenya and other African countries. Her current role is geared towards assessment of food safety systems against food safety system standards for certification and registration purposes. Beatrice holds an MSc in Food Safety and Quality from the University of Nairobi, Kenya; a Post-graduate certificate in Food law and best practices in Food Safety from Texas A&M University, USA; an Advanced Diploma in Food management and HACCP system from The Hebrew University of Jerusalem, Israel; certificate in Governance and Food Safety in international Food Chains from Wageningen University, The Netherlands and a BSc in Food Science and Technology from the University of Nairobi, Kenya.

Contacts: atienobm@kebs.org / atienobm@gmail.com

Margaret Rugut Kibogy is the Managing Director, Kenya Dairy Board. She holds a Masters of Business Administration (MBA), Marketing from University of Nairobi. She has vast experience in both the private and public sector. She is passionate on quality and safety issues and has steered the Board for the last few years to ensure quality and safety of dairy products in line with the Big Four Agenda particularly on Food Nutrition and Security Pillar.

Cyprian Kabbis, a Chemist by profession, has over 29 years industry experience, serving as an expert in areas of quality assurance, R&D and innovative laboratory analytical solutions. In 2005, he joined SGS Group with responsibilities to manage the giant multi-site testing laboratories based in SGS Mombasa and Nairobi Kenya. During his 13 years as a Food Safety Expert, Cyprian was instrumental in upgrading the pesticide residues testing laboratory to achieve recognition by the European Union during a time when Kenya was in turmoil following frequent notifications for harmful chemicals above maximum limits (MRLs) on exported horticultural products. Cyprian Kabbis has been a Lead Consultant for GIZ, Ethiopia in numerous projects supporting the National Quality Infrastructure (NQI) initiated by the Ethiopian Government including upgrading of the Ethiopian Conformity Assessment Enterprise (ECAE) Laboratories. Cyprian has also provided technical and advisory support to various key projects in the region including development
and generation of analytical data for the current Kenya Food Composition Table (KFCT) in collaboration FAO and Ministry of Health; Improvement of Fish Quality Infrastructure in Somali through collaboration with USAID and RTI International. With a strong background in analytical laboratories, food safety, marketing and sales, he is currently responsible for the Consumer & Retail Business as well as Food Business for SGS Kenya Region (Kenya, Uganda, Rwanda, Burundi, Somalia & Sudan). Cyprian holds BSc degree in Chemistry, MBA and post graduate qualifications in Rubber/Polymer Science from the University of Akron, USA.

Dr. Kepha Ombacho is the Director of Public Health at the Ministry of Health-Kenya. He is a Public Health specialist trained at Masters and PhD level. He has a vast experience of over 35yrs in the area of preventive and promotive health. He has further training in strategic management and food safety. He has worked at different levels which include being in charge of research at the Ministry of Health. He is a board member at consortium for health research, pest control and NACADA Internationally he serves at international forum of Sanitation and Water for All (SWA) as the Eastern and South African representative. He also the co-chair of SWA mutual accountability forum. He is also a member of water and sanitation collaborative forum. Chair of the African affairs in Sanitation. He is a member of Water Supply Sanitation Collaborative Council (WSSC).

He is the registrar of the Public Health Officers and Technician Council (PHOTC) and the patron of the Association of Public Health Officers-Kenya (APHO-K) and Secretary, Tobacco Control Board of Kenya. He has participated in various policy and regulation formulations in public health areas such as Food Safety, Water and Sanitation, Occupational Health and Safety, Health Care Waste Management and Climate change.

Mikael Fogelholm has been the Professor in Public Health Nutrition at the University of Helsinki since 2011. He has 198 original research publications and reviews listed in PubMed. Mikael's main research interest has been the interactions between dietary patterns, physical activity and obesity. His largest project right now (after finishing PREVIEW) are related to use of loyalty-card food-purchase data in assessment of dietary habits in the population, and to nutrition transition and prevention of non-communicable diseases in Kenya. Besides active research, Mikael is the head of the Master’s Program in Human Nutrition and Food-related Behaviour, also at the University of Helsinki. When not working, he is usually out doing mountain biking or orienteering, or alternatively playing the piano.

Prof Waudo is currently a full professor in the Department of Foods, Nutrition and Dietetics. Prof Waudo is a renowned scientist in the area of community nutrition in Kenya. She has taught and researched in the area of food and nutrition for over 30 years. She has served at Kenyatta University in various administrative positions for 20 years. She has experience in the food security and safety in the different value chains. More recently she has carried out a research study on food loss from farm to the plate. Prof Waudo has authored several books and scientific articles.

She has previously organized several international conferences namely: the International Information Technology and Nutrition, Common Wealth conference of Nutrition and HIV and Aids, the International Nutrition Conference among others. Currently she serves on several journal editorial boards and has experience in reviewing of scientific papers. Prof Waudo has had privileges to chair and moderate discussions at many national and international conferences.

Prof Waudo is privileged to serve as a technical resource person for this International conference on Food Safety.
## PROGRAMME

### DAY 1: Monday 20th May 2019

**Overall day’s Chair:** Dr. Dorcus Mbithe D. Kigaru,  
**Telephone:** +254-728379785

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<th>Time</th>
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| 8:00 - 8:30am | Arrival and registration: Venue BSSC 14  
**Session Chair:** Dr. Christine Njuguna                                                                                                                     |
| 8.30 - 9.00am | Introduction and Welcome remarks by Chair, Conference Organizing Committee                                                                                                                                             |
| 8.00 - 10.30am| Setting up of exhibitions & posters: Venue BSSC  
**Session Chairs:** John Gachoya & Patrick Kamande                                                                                                        |

### Session A

**Session Chair:** Dr. Sophie Ochola,  
**Rapporteur:** Dr. R. Kamuhu  
**Venue:** BSSC 14

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| 9.00 - 10:00am| **Topic 1:** Scientific writing, scientific communication, and publishing in International journals               | Prof. Mikael Fogelholm  
Professor in Public Health Nutrition  
University of Helsinki, Finland &  
KENFIN EDURA project team leader                                                                 |
| 10.00 -10.15am| Questions/Discussion                                                                                               | Prof. Mikael Fogelholm                                                                          |
| 10:15 -11:30am| **Topic 2:** Sustainability and Health promotion                                                                 | Prof. Mikael Fogelholm                                                                          |
| 11.30 -11.45am|                                                                                                                | Prof. Judith kimiywe, Kenyatta University                                                      |
| 11.45 -12.00pm| Health break, poster sessions, exhibitions                                                                        |                                                                                                |

### Session B

**Key Note Speech:** Venue: BSSC 14

**Sub-theme 1:** Linking food safety, food security and public health  
**Session Chair:** Dr. Dorcus Mbithe,  
**Rapporteur:** Dr. Joseph Kobia

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<tr>
<td>12.00 - 12.40pm</td>
<td><strong>Key note address 1:</strong> Challenges and opportunities in addressing food safety, loss and waste: A largely forgotten aspect of food security in developing countries</td>
<td>Prof. Judith kimiywe, Kenyatta University</td>
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<td>12.40 -  1.00pm</td>
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<td>1:00 – 2:00pm</td>
<td>Health break, poster sessions, exhibitions</td>
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### BREAK-AWAY SESSIONS

**Cluster A: Sub-theme 1: Linking food safety, food security and public health**  
**Session Chair:** Prof. Elizabeth Kuria,  
**Rapporteur:** Dr. Solomon Mburung’a  
**Venue:** BSSC 14

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| 2.00 - 3.30pm | **ST2-1-007S:** Good practices on dealing with mycotoxin contamination :Survey results from GIZ projects on mycotoxin infestation  | Anna- Vanessa Kullanek  
(GIZ) and Kerstin Hell  
(GFA/ GIZ Togo)                                                                                 |
|               | **ST1-5-005S:** Inadequate management of complementary foods contributes to the risk of aflatoxin exposure and stunting among children | Nyabasi Makori                                                                                 |
|               | **ST1-1-002S:** Effect of Aflatoxin Exposure on Micronutrient Deficiencies and Growth Retardation among Young Children: A Review | Cherono Sheila                                                                                 |
|               | **ST1-4-001S:** Effectiveness of the post-harvest interventions to minimize the risk of aflatoxin and fumonisin contamination in maize and subsequent dietary exposure in Tanzanian infants: a cluster randomized controlled trial | Dr. Analice. Kamala                                                                            |
|               | **ST2-1-001S:** Fumonisins B₁ (Fb₁) and Fumonisin B₂ (Fb₂) Production Levels In Maize Genotypes Grown in Nakuru County, Kenya | Lawrence Alaro                                                                                 |

### Q & A
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<td>2.00 - 3.30pm</td>
<td><strong>Cluster B: Sub-theme 2: Food safety along the food chain</strong></td>
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<td><strong>Session Chair: Dr. Peter Chege, Rapporteur: Dr. R. Kamuhu - Venue BSSC 12</strong></td>
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<td>2.00 - 3.30pm</td>
<td>ST1-5-007S: Utilizing Geographic Information Systems in Food Safety Surveillance</td>
<td>Eliud Gachie Baraka</td>
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<td>ST2-1-010S: Profiling of Antibiotic Resistant Bacteria and Antibiotic Residues in</td>
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<td>Raw Chicken Products Sold at Kenyatta University and its Environs</td>
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<td>ST2-5-001S: Are the levels of indicatory polychlorinated biphenyls in processed L.</td>
<td>Wenaty Alex</td>
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<td>niloticus products from Lake Victoria in Tanzania a health risk?</td>
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<td>ST2-7-002S: Food Hygiene Knowledge and Practices among Minimally Processed Fruits</td>
<td>Mercy Adhiambo Ndiege</td>
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<td>Street Vendors in Central Ward, Nairobi County</td>
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<td>Q &amp; A</td>
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<td>3.30 - 3.45pm</td>
<td>Health break, poster sessions, exhibitions</td>
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<td>3.45 - 5.20pm</td>
<td><strong>Cluster B: Sub-theme 2: Food safety along the food chain</strong></td>
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<td><strong>Session Chair: Dr. Peter Chege, Rapporteur: Dr. R. Kamuhu - Venue BSSC 12</strong></td>
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<td><strong>Time</strong></td>
<td><strong>Topic/Abstract Title</strong></td>
<td><strong>Presenter(s)</strong></td>
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<tr>
<td>3.45 - 5.20pm</td>
<td>ST1-5-001S: Cancer Risks Associated with Ingestion of Food containing Arsenic,</td>
<td>Jejet Naomy Kemboi Olero</td>
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<td>Cadmium, Chromium and Lead in Fluorspar Mining Belt Elgeyo Marakwet County, Kenya</td>
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<td>ST2-5-007S: Heavy Metal Contamination of Sugar and the Sugar Value Chain Products</td>
<td>Dr. Ann Wambui Munyaka</td>
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<td>in Nairobi and the Environs, Kenya</td>
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<td>ST2-5-002S: Health risk assessment on selected essential and non-essential elements</td>
<td>Nyabuti Oingo George</td>
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<td>in food crops grown in Kibra slum, Nairobi-Kenya</td>
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<td>ST2-1-003S: Acute Toxicity of the Aqueous Plant Extract of <em>Eragrostis Tremula</em></td>
<td>Musifawa*</td>
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<td>ST1-3-002S: Food safety in controlling of HIV/AIDS co-morbidities</td>
<td>Louise W Ngugi</td>
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<tr>
<td>5.30 – 7.30pm</td>
<td><strong>Cluster B: Sub-theme 2: Food safety along the food chain</strong></td>
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<td><strong>Session Chair: Dr. Peter Chege, Rapporteur: Dr. R. Kamuhu - Venue BSSC 12</strong></td>
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<tr>
<td>5.30 – 7.30pm</td>
<td><strong>Welcome Dinner party</strong></td>
<td>Dr. Moses Miricho</td>
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</table>
## DAY 2: Tuesday 21st May 2019

**Overall day’s Chair:** Prof. Judith Waudo,  
**Telephone:** +254-728379785

<table>
<thead>
<tr>
<th>Time</th>
<th>Scheduled Activity</th>
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| **9.00 - 10.30am** | Conference Opening Ceremony  
Venue: BSSC 014  
Master of Ceremony: Dr. Mildred P. Nawiri  

**Opening Ceremony**  
Launch of the Kenya Association of Food Safety and Protection  
MC and Prof. Waudo  

**Key note address 2:** Safe food is key for optimal nutrition and health outcomes: “The Good, the Bad and the Ugly!”  
Dr. Paul Wangai Jr. (Consultant Physician and registered Nutritionist), Aga Khan Hospital  

Opening of exhibitions  
Prof. Waudo  

Photo session  
Prof. Waudo/Machua, Director, Public Relations and Communications, KU |
| **10.30 - 11.00am** | Health/tea break, poster sessions, exhibitions |

### Session A  
**Key note Speeches Venue BSSC 014**

**Session Chair:** Prof. Judith Waudo  
**Rapporteurs:** Dr. Juliana Kiio/Dr. Francis Obuor  

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<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Key note addressed by</th>
<th>Presenter</th>
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<tbody>
<tr>
<td><strong>11.00-11.30am</strong></td>
<td>Key note 3: Biotechnology, genetically modified foods and food safety</td>
<td>Prof. Hamadi Boga (Principal Secretary, State Department of Agricultural Research, Ministry of Agriculture, livestock, fisheries and irrigation)</td>
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<tr>
<td><strong>11.30am – 12.00pm</strong></td>
<td>Key note 4: Trends and impact of food borne illnesses on the health care system and successful public health interventions</td>
<td>Dr. Kepha Ombacho (Director, Public Health, Ministry of Health, Kenya)</td>
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<td><strong>12.00- 12.30</strong></td>
<td>Discussion</td>
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<td><strong>12.30-1.00pm</strong></td>
<td>Touring of exhibitions</td>
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<td><strong>1.00 – 2.00pm</strong></td>
<td>Lunch, side events, poster sessions, exhibition and market place</td>
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### Session B  
**Sponsored Sessions Venue BSSC 14**

**Session Chair:** Dr. Ann Munyaka  
**Rapporteur:** Dr. Judith Munga  

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<th>Time</th>
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| **2.00 - 3.00pm** | Scientific symposium: Food fortification Project - JKUAT  
- The Status and Safety of Maize Flour Fortification in Kenya  
- Food Fortification and the related legislation in Kenya  
- Compliance status for wheat flour brands in Nairobi Mombasa | Prof. Daniel Sila |

### BREAK AWAY SESSIONS

**Cluster A: Sub-theme 2: Food safety along the food chain**  
**Session Chair:** Dr. Purity Nguhiu, Rapporteur: Alex N. Wenaty  
**Venue:** BSSC 14
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<th>Time</th>
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<th>Presenter(s)</th>
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<tr>
<td>3.00- 4.15pm</td>
<td><strong>Break Away Session</strong></td>
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<td>ST2-7-005S: Assessment of food handlers’ knowledge on food safety management in selected star-rated hotels in Eldoret Town, Kenya</td>
<td>Onyango Dorothy</td>
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<td>ST2-8-001S: Nutraceuticals: An Emerging Trend in Nutritional Care</td>
<td>Momanyi Caroline</td>
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<td>ST2-3-002S: Micronutrient and Microbial Quality Assessment of Solar Dried Amaranth (<em>Amaranthus cruentus</em>) Leaves Produced in Kajiado County Kenya</td>
<td>Dr. Peter Chege</td>
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<td>ST2-3-001S: Food Safety Related Knowledge, Attitude and Practices among Food Marketers and Traders in Nairobi City’s Informal Settlements, Kenya</td>
<td>Dorcus Mbithe D. Kigaru</td>
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<td><strong>Q &amp; A</strong></td>
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<td>4.15- 5.30pm</td>
<td>ST2-1-002S: The Safety Status of Tomatoes Grown and Consumed in Kirinyaga County, in Terms of Pesticide Residue Levels</td>
<td>Momanyi, Violet</td>
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<td></td>
<td>ST2-3-003S: Assessment of Sodium Benzoate in Tomato Sauces in Supermarkets Nairobi County, Kenya</td>
<td>Jane Igoki Murungi</td>
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<td>ST3-5-023S: Human Exposure to Radiation from Consumption of Cassava in Kilimambogo, Kenya</td>
<td>Catherine Nyambura</td>
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<td><strong>Q &amp; A</strong></td>
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**Cluster B: Sub-theme 2: Food safety along the food chain**

Session Chair: Dr. Florence Kyalo: Rapporteur: Esther Omosa Venue BSSC 12

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<tbody>
<tr>
<td>3.00- 4.15pm</td>
<td>ST2-5-003S: Prevalence and Characterization of <em>Aspergillus flavus</em> And Other Moulds in Fresh and Dried Fish Sold in Kisii County, Kenya</td>
<td>Nyamwaka, I.S</td>
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<td></td>
<td>ST2-1-004S: A Review of Aflatoxins Contamination in the Cereals, Pulses and Nuts Value Chains and Household Food Insecurity and Safety In Kenya</td>
<td>Julius Kigo</td>
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<td>ST2-6-002S: Efficacy of mycotoxin binder on aflatoxin m1 and mazzican on total bacterial count in raw milk among smallholder dairy farmers in Kisumu County, Kenya</td>
<td>Gladys Anyango</td>
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<td>ST2-6-001S: Electronic Nose as a Screening Tool for Detection of Aflatoxin Contamination of Maize.</td>
<td>Machungo, C.W</td>
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<td><strong>Q &amp; A</strong></td>
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<tr>
<td>4.15- 5.30pm</td>
<td><strong>ST2-5-005S</strong>: Zoonotic Non-tuberculous Mycobacteria isolated in dromedary camel milk and sputum of associated household members in Samburu East, Kenya</td>
<td>Lucas Luvai</td>
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<td><strong>ST1-3-001</strong>: <em>Salmonella typhimurium</em> Impairs Absorption of Nutrients and Induces Inflammation via Type 3 Secretion Systems (T3SS): A Recent Review</td>
<td>Kevin Omondi Aduol</td>
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<td><strong>ST3-3-003S</strong>: Through their eyes and voices: Food safety for the urban poor, Nairobi, Kenya</td>
<td>Dr. Elizabeth Kimani-Murage</td>
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<td><strong>ST2-5-004S</strong>: Are our vegetables on Drugs? Sulfamethoxazole Residues in Vegetables Irrigated with Untreated Wastewater</td>
<td>Prof. Wanjau Ruth Nduta</td>
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<td>5.30 - 5.45pm</td>
<td>Q &amp; A</td>
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<td><strong>ST1-3-001</strong>: <em>Salmonella typhimurium</em> Impairs Absorption of Nutrients and Induces Inflammation via Type 3 Secretion Systems (T3SS): A Recent Review</td>
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<td>Prof. Wanjau Ruth Nduta</td>
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<td>5.30 - 5.45pm</td>
<td>Health break, poster sessions, exhibitions</td>
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**DAY 3: Wednesday 22nd May 2019**

**Overall day’s Chair:** Dr. Juliana N. Kiio      **Telephone:** +254-725999448

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<tr>
<th>Time</th>
<th>Topic</th>
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<tr>
<td>8:00 - 9:00am</td>
<td><strong>Route to Food Presentation</strong>  <strong>Venue:</strong> BSSC 14</td>
<td><strong>Rapporteur:</strong> Wesley Bor</td>
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<td><strong>ST2-1-008S</strong>: Are banned pesticides still in use? The case of Neonicotinoids</td>
<td>Dr. Bollmohr Silke</td>
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<td><strong>ST3-3-002S</strong>: The intersection between food safety and the Human Right to Food in Kenya</td>
<td>Atamba Emmanuel</td>
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<td><strong>Session A</strong></td>
<td><strong>Key note Speeches Venue BSSC 14</strong></td>
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<td><strong>Sub-theme 2: Food safety along the food chain</strong></td>
<td><strong>Session Chair:</strong> Prof. B. Njehia, Rapporteur: Angela Kimani</td>
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<td><strong>Key note address 5:</strong> Food Safety at primary production: Crop production practices and allied challenges</td>
<td>Dr. Eliud Kiplimo Kireger Director General; Kenya Agricultural and Livestock Research Organization (KALRO)</td>
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<td><strong>Key note address 7:</strong> Agrochemical use and pesticide residue in food for domestic and export markets: Compliance to national and international standards’</td>
<td>Dr Esther Kimani Managing Director, Kenya Plant Health Inspectorate Service (KEPHIS)</td>
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<td><strong>Key note address 8:</strong> Organic Farming, Pesticide Use and Food Safety</td>
<td>Dr. Peter Ogera Mokaya CEO, Organic Consumers Alliance (OCA)</td>
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<td><strong>Key note address 6:</strong> Chemical food safety during processing, packaging and storage</td>
<td>Prof. Bruno De Meulenaer, Dept of Food Technology, Safety &amp; Health, Ghent University, Belgium</td>
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<td><strong>Key note address 9:</strong> Exploring the aflatoxin menace in nuts and cereals and the preventive approaches</td>
<td>Dr. Moses Mwangi, CEO, Equatorial Nut Processors Ltd, Kenya</td>
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<tr>
<td>11.00-11.20am</td>
<td><strong>Discussion</strong></td>
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<td><strong>Health break, poster sessions, exhibitions</strong></td>
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<td><strong>Session B</strong></td>
<td><strong>Key note Speeches Venue BSSC 14</strong></td>
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<td><strong>Sub-theme 2: Food safety along the food chain</strong></td>
<td><strong>Session Chair:</strong> Prof. Margaret Keraka Rapporteur: Dr. B. Danga</td>
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<td></td>
<td><strong>Key note address 9:</strong> Exploring the aflatoxin menace in nuts and cereals and the preventive approaches</td>
<td>Dr. Moses Mwangi, CEO, Equatorial Nut Processors Ltd, Kenya</td>
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</table>
12.00 -12.30pm  **Key note address 10:** Meat and meat products safety issues and challenges along the value chain and related interventions  Dr. Indraph Ragwa  CEO, Kenya Veterinary Board

12.30 -1.00pm  **Key note address 11:** The safety of milk and milk products: The role of the Kenya Dairy Board  Margaret Rugut Kibogy  Managing Director; Kenya Dairy Board

1.00 -1.30pm  **Key note address 12:** Food management systems and HACCP in the hotel industry: implementation, challenges and derived benefit’  Cyprian Kabbis, Société Générale de Surveillance (SGS) Kenya Limited, CRS and Food Business Manager

1.30 -1.50pm  Discussion

1.50 - 2:40pm  Lunch, poster sessions, exhibition, sponsored Symposium

**Session B**  
Sponsored Sessions  
Venue BSSC 14  
Session Chair: Veronicah Kirogo  
Rapporteur: Dr. Rhoda Ndanuko

2.40-3.40pm  ILRI Session. Safe and nutritious milk for Kenyans: where we stand and ways forward  
- Milk safety as a pathway to better nutrition: a Theory of Change  
- Risky assumptions: The impact of household practices on raw and processed milk safety  
- Mycotoxin binders: an option for safer milk in Kenya?  
- Market driven pull-push approaches to food safety  
Silvia Alonso (ILRI)

### BREAK-AWAY SESSIONS

#### Cluster A: Sub-theme 2: Food safety along the food chain  
**Session Chair:** Dr. Mwenda Mbaka  
**Rapporteur:** Dr. Monica Wandolo  
**Venue:** BSSC 14

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<th>Time</th>
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<tr>
<td>3.40 - 5.00pm</td>
<td>ST2-7-009S: Understanding The Challenges Faced By Food Vendors in Three Markets in Selected Informal Settlements in Nairobi County. A Crisis or opportunity?</td>
<td>Dr. Christine Njuguna</td>
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<td>ST2-7-001S: Assessing Food Handlers’ Hygiene Practices as Determinants of Customer Choice of Selected African Indigenous Restaurants in Nairobi City County, Kenya</td>
<td>Mwangi, P. Nderitu</td>
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<td></td>
<td>ST2-9-001S: Factors Contributing to Food Borne Illnesses in Rural and Urban Households: A Case of Zimmerman Estate Nairobi and Kegoro village, Thika, Kenya</td>
<td>Prof. Elizabeth Kuria</td>
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<td>ST2-5-006S: ST2-5-006S: Isolation of <em>Listeria</em> Species In Milk And Meat Products In Nairobi and Its Environs And The Implication In Food Safety</td>
<td>Kabui, K.K</td>
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<td>ST2-1-006S: Food Safety Issues Associated with Pastoralist Milk in Northern Kenya</td>
<td>Dr. Francis O. Wayua</td>
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**Q & A**
### Cluster B: Sub-theme 2: Food safety along the food chain

**Session Chair:** Prof. Charles Muyanja  
**Rapporteur:** John Gachoya - Venue BSSC 12

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<th>Time</th>
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<th>Presenter</th>
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| 3.40 - 5.00pm | Break away session  
ST2-3-004S: Keeping Quality of Complementary Food Based on Steeped, Germinated and Extruded Amaranth and Sorghum Grains | Anne Wanjiru Gichau |
|             | ST2-6-006S: Is the Immuno-chemical detection of peanut proteins affected by processing treatments? | Dr. Juliana Kiio |
|             | ST3-2-001S: Development of a Food Safety Tool Kit for Dry Common Beans (*Phaseolus Vulgaris* L.) In Uganda Using a Hazard Analysis and Critical Control Point (HACCP) Approach | Dr. Lung’aho Mercy |
|             | ST3-3-001S: Knowledge gaps in promoting behaviour change communication (BCC) in food safety among farming households in Kenya | Dr. Dorcus Mbithe D. Kigaru |
|             | Q & A                                                                 |                                                                          |
| 5.00 - 5.30pm | Health break, poster sessions, exhibitions                           |                                                                          |

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### DAY 4: Thursday 23rd May 2019

**Overall day’s Chair:** Dr. Ann Munyaka  
**Telephone:** +254-712108087

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<th>Time</th>
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| 8:00 - 9:00am | RTI/USAID Presentation  
Session Chair: Dr. Esther Nduku  
Rapporteur: Felix Kiplagat Boor | BSSC 14 | SGS presentation |
|             | **SUB-THEME 3: Food safety policies and implementation**  
**Session Chair:** Dr. Sophie Ochola , Rapporteur: Collins Ooko Ogutu |         |                                                                          |
|             | **Key note Speeches Venue BSSC 14**                                    |         |                                                                          |
| 9.00-9.30am | **Key note address 13:** Addressing consumer concerns and creating awareness on food safety through advocacy and lobbying |         | CEO, Consumers Federation of Kenya (COFEK) |
| 9.30-10.00am | **Key note address 14:** Compliance to national, regional and international food standards |         | Beatrice Atieno, Manager, Food Safety Management Systems, KEBS |
| 10:00am-10:30am | **Key note address 15:** Role of Policy makers, researchers, producers, food industry and consumers in driving forward the food safety agenda |         | Prof Francis Zotor (University of Health and Allied Sciences, Ghana, and immediate former President, Africa Nutrition society) |
| 10.30-10.50am | Discussion                                                             |         |                                                                          |
| 10.50-11:00am | Health break, poster sessions, exhibitions                           |         |                                                                          |
|             | **SUB-THEME 3: Food safety policies and implementation**  
**Session Chair:** Dr. W. Thagana, Rapporteur: Dr. Judith Okoth |         |                                                                          |
<p>| 11.00-11.30am | <strong>Key note address 16:</strong> Innovative approaches of building food safety capacity in Africa |         | Prof. Charles Muyanja (Makerere University Uganda, and co-founder, Africa Continental Association of Food Protection) |
| 11.30-12.00pm | <strong>Key note address 17:</strong> SAFE FOOD FOR ALL - What need to be done by all actors in the food chain, from primary producers to consumers in developing countries? |         | David Morgan, Global Alliance for Improved Nutrition (GAIN). |</p>
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<th>Time</th>
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<th>Presenter(s)</th>
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<tr>
<td>12.00-12.20pm</td>
<td>Session C</td>
<td>Sponsorship Sessions Venue BSSC 14 Session Chair: Prof. Elizabeth Kuria Rapporteur: Dr. Judith Munga</td>
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<tr>
<td>12.20-12.50pm</td>
<td>Session D</td>
<td>Scientific symposium: Global Alliance for Improved Nutrition (GAIN)</td>
<td>Leah K. / Dr. C. Macharia</td>
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<td>Topic: Safe and Nutritious foods in the market place</td>
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<td>12.50-1.20pm</td>
<td>Session D</td>
<td>Scientific symposium: TECHNO SERVE</td>
<td>Mr. Muraguri</td>
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<tr>
<td>1.20-1.40pm</td>
<td>Session D</td>
<td>Scientific symposium: Kenya Bureau of Standards</td>
<td>KEBS/Beatrice Atieno</td>
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<td>1.40-2.30pm</td>
<td></td>
<td>Lunch, poster sessions, exhibition, sponsored Symposium</td>
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<td><strong>BREAK-AWAY SESSIONS</strong></td>
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<td>Cluster A:</td>
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<td><strong>Sub-theme 3: Food safety policies and implementation</strong></td>
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<td><strong>Session Chair:</strong> Robert Kilonzo <strong>Rapporteurs:</strong> Jane Wambugu <strong>Venue:</strong> BSSC 14</td>
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<td>Time</td>
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<td>Presenter(s)</td>
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<tr>
<td>2.00-3.30pm</td>
<td>ST3-2-002S: Assessment of Compliance Level to Food Safety Standards in Slaughterhouses and Meat Processing Plants in Nairobi City Council, Kenya</td>
<td>Dr. Purity Nguhiu</td>
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<td>ST2-7-004S: Analysis of Microbial Load of Foods Prepared and Served in TVET and University Hospitality Schools in Kenya</td>
<td>Wandolo, M.A</td>
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<td>ST2-6-005S: How Genetic Modification Corporations Exist and Flourish Despite Producing Harmful Products</td>
<td>Dr. Mburunga Solomon</td>
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<td>ST3-3-005S: Who Cares? Consumer Attitudes and Purchase Decisions on Peri-urban Agricultural Commodities in the Absence of Information Asymmetry</td>
<td>Daniel Kyalo Willy</td>
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<td>ST3-5-018S: Development of a photographic food atlas to support food portion estimation among children and adolescents aged 9-14 years in Nairobi, Kenya</td>
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<td>ST3-5-019S: Current status of food poisoning and foodborne illness in sub-Saharan Africa- A review</td>
<td>Joseph Matofari</td>
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<td>ST3-5-20S: Efficient Student Industrial Attachment Programs to Enhance Food Safety: A case for the Kenyan Education System</td>
<td>Mwenda Mbaka</td>
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<td>ST1-2-001S: Food security and food safety in Kenya: the role of Universities</td>
<td>Prof Judith Waudo</td>
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<td><strong>Food safety policies and implementation</strong></td>
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<td><strong>Session Chair:</strong> Prof. Elijah Gitonga <strong>Rapporteur:</strong> Dr. Solomon Mburung’a <strong>Venue:</strong> BSSC 12</td>
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<td>ST3-2-002S: Assessment of Compliance Level to Food Safety Standards in Slaughterhouses and Meat Processing Plants in Nairobi City Council, Kenya</td>
<td>Dr. Purity Nguhiu</td>
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<td>ST2-7-004S: Analysis of Microbial Load of Foods Prepared and Served in TVET and University Hospitality Schools in Kenya</td>
<td>Wandolo, M.A</td>
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<td>ST2-6-005S: How Genetic Modification Corporations Exist and Flourish Despite Producing Harmful Products</td>
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<td>ST3-3-005S: Who Cares? Consumer Attitudes and Purchase Decisions on Peri-urban Agricultural Commodities in the Absence of Information Asymmetry</td>
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<td>ST3-5-026S</td>
<td>Achieving Environmentally Sustainable Food Security through Hotels’ Application of the 5Rs in Food Waste Management, Within Bauchi State, Nigeria</td>
<td>Esther Olaitan Adebitan</td>
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<td>ST2-2-001S</td>
<td>Potential for Wastewater Re-Use in Urban and Peri-Urban Agriculture to Mitigate Household Food insecurity in Nairobi, Kenya</td>
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<td>ST3-2-003S</td>
<td>Role of food safety management systems on food hygiene practices in 5 star hotels in Nairobi, Kenya</td>
<td>Dr. Miricho Moses</td>
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<td>ST3-5-024S</td>
<td>Nutrient Composition and Consumer Acceptability of Maize/ Mushroom Composite Porridge for Complementary Feeding in Siaya County, Kenya</td>
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<td>Awareness on Hazard Analysis and Critical Control Points (HACCP) Principles in TVET and University Hospitality Schools in Kenya</td>
<td>Dr. Monica. Wandolo</td>
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Q&A

3.30-5.00pm

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<td>Effects of lactic acid fermentation on functional properties of fruits and vegetables - Review</td>
<td>Kuria M.W</td>
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<td>ST3-1-001P</td>
<td>Sanitary and phytosanitary (SPS) measure implementation: Review of a major export abattoir in Nairobi, Kenya</td>
<td>Dr. Agnes Maina</td>
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<td>Nutrient Retention of Solar-Dried African Leafy Vegetables, Kiambu County, Kenya</td>
<td>Gachoya John</td>
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Q&A

5.30 – 6.00pm Health break, poster sessions, exhibitions

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**DAY 5: FRIDAY 24TH May 2019**

**Overall day’s Chair:** Dr. Moses Miricho, **Telephone:** +254-720972702

**Way Forward Venue BSSC 14**

**Session Chair:** Prof. J. Waudo, **Rapporteur:** Dr. Christine Njuguna & Patrick Kamande

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<td>1. Way forward</td>
<td>Veronica Kirogo/ Dr. Kepha Ombacho Dr. W. Thagana</td>
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<td>10.0 – 10.30am</td>
<td>2. Scaling up Nutrition (SUN)</td>
<td>Gladys Mugambi</td>
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<td>10.30am</td>
<td>3. Kenya Nutritionist and Dieticians Institute (KNDI)</td>
<td>CEO, KNDI</td>
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<td>10.00 -10:30am</td>
<td>4. Conference closing ceremony</td>
<td>Prof. Elizabeth Kuria</td>
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<td>8.00 to 9.00am</td>
<td>Registration for the Excursion (site to be communicated)</td>
<td>Secretariat/Dr. Moses Miricho</td>
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<td>10.00 -10:30am</td>
<td>Health break, wrap up of poster sessions &amp; exhibitions</td>
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<td>10.30-11.00am</td>
<td>Departure for the Excursion</td>
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**DAY 6: SATURDAY 25TH May 2019,** Local and international departures
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<td>Sheila Cherono</td>
<td>Assessment of dietary aflatoxin awareness and exposure levels and vitamin A status of children (6-23) months attending Makueni County Referral Hospital.</td>
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<td>ST2-7-003P</td>
<td>Ronald Kipkoech Ngetich</td>
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<td>Wairegi Susan</td>
<td>Food Safety and Nutritional Concerns of Street Foods in Urban Centers In Kenya. A Review.</td>
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<td>Christine Muturi</td>
<td>The Role of Risk Perception as a Driver of Food Choice among Women Aged 20-59 Years in Kiambu County</td>
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<td>Samuel Gafuma</td>
<td>Added Starch and Pectin Affect Hardness of Cooked Bananas</td>
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<td>ST3-5-002P</td>
<td>Wesley Bor</td>
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<td>Brian Wamunga</td>
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<td>Steve Wanjala</td>
<td>A Curse of Nutrient Depleted Soils and Diminishing Maize Yields in Semi-Arid, Kenya; Can Integrated Soil Fertility Management technologies be the saviour?</td>
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<td>Brendah Chepkitai Ndiema</td>
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<td>James G. Kirimi</td>
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<td>ST3-5-027P</td>
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<td>Effects of Declining Wood Fuel on Household Cooking Patterns and Nutrition Security in Tigania West, Kenya</td>
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ABSTRACTS FROM KEYNOTE SPEAKERS

Professor Francis Bruno Zotor
Role of Policy makers, researchers, producers, food industry and consumers in driving forward the food safety agenda
Francis B. Zotor1,2,3 University of Health and Allied Sciences, School of Public Health, PMB 31, Ho, Volta Region, Ghana, Trustee. African Nutrition Society, Council Member, International Union of Nutritional Sciences

Over the past decade a number of countries across Africa have made some significant progress in their food safety challenges which to some extent have brought about reduction in poverty, hunger, and malnutrition. In spite of these improvements, these countries continue to experience a myriad of food safety challenges which impact negatively on the health status of its citizenry, particularly that of women and children who constitute key vulnerable groups in our society. The loss due to food safety challenges undermines economic potential of a country as well as human productivity. This can run into billions of US dollars which can often have impacts and exclusion from markets for high-risk foods, and future trade opportunities. There couldn’t be a more urgent need to aggressively intervene in the food safety situation of a country to promote national development. This paper will attempt to use a positive deviance approach and the lessons from successful countries in Africa to encourage other countries to similarly follow suit. Attempts will also be made to sound the clarion call on our researchers, producers, the food industry and consumers to build synergies and raise more awareness on food safety issue challenges, and agree on the way forward for projecting food and nutrition standards in Africa. A risk analysis paradigm would provide a framework to ensure that food safety and health are based risk analysis principles and one that will present governments with valuable resource to achieve public health objectives such as food safety and nutrition.

Keywords: food safety, malnutrition, national development, public health, health status

Dr. Indraph Ragwa, CEO, Kenya Veterinary Board
Meat and meat products safety issues and challenges along the value chain and related interventions

The demand for meat and meat products is on the increase both locally and globally. The high demand has come with subsequent challenges at point of production, processing, marketing and consumption. Intensive production systems, strain on food processing systems and international trade in meat and meat products affect the quality of meat and meat products available to consumers. Currently the world is facing the challenge of Anti-Microbial Resistance bringing into focus the need to observe prudent use of antimicrobials including withdrawal periods. Veterinary doctors play a key role in ensuring the quality and safety of meat and meat products especially at the point of origin. Veterinarians not only work at the point of origin (the farm) but also along the value chain; in the slaughter houses and in meat processing plants to ensure quality of meat and meat products. Veterinarians ensure that animal welfare is safeguarded and in effect the quality of meat from animals that are healthy and fit for consumption.

This presentation takes a look the role of veterinarians in ensuring the quality of meat and meat products and by extension the regulatory bodies. It gives a glimpse into the current situation and proposes recommendations.

Key Words: Meat, meat products, value chain, veterinary doctors

Professor Judith Kimiywe, Kenyatta University, Department of Food, Nutrition and Dietetics.
Challenges and Opportunities in Addressing Food Safety, Loss and Waste: A largely forgotten aspect of food security in Developing countries

Presently, close to 1 billion people globally suffer from hunger and food insecurity. In Kenya statistics indicate that 10 million people suffer from chronic food security and poor nutrition, 2-4 million people require emergency food assistance at any given time with about one third of children suffering from malnutrition. Key among the challenges contributing to inadequate food in developing countries include among others, limited certified seeds for local crops, seasonal production rain-fed, high postharvest losses and wastage, poor transportation and low value addition which reduces market competitiveness. This has been further exacerbated with high levels of mycotoxins contamination and high pesticide residues that beg the question as to how safe is the food we are eating. Aflatoxin
is a naturally occurring toxic by-product, named after a genus of fungus that produces it. *A. flavus* colonizes food crops including maize, oilseeds, nuts, root crops. Adverse impacts of aflatoxin on human and livestock health are well-established. Aflatoxin are classified by the International Agency for Research on Cancer (IARC) as a Type 1 human carcinogen that causes hepatocellular carcinoma (liver cancer). This causes food losses due to spoilage; therefore, contributing to food shortages. Aflatoxins are an important public health concern in the developing world and seriously affect people’s health and livelihoods. The problem is rooted throughout the food chain, and as freedom of choice in food is limited for a poor and food-insecure population, exposure to aflatoxin is widespread and consumers in developing countries are at risk from aflatoxin-related illnesses. Recent estimates suggest that there are more than five billion people worldwide at risk of chronic exposure to aflatoxins. This paper therefore will explore the opportunities available to address some of the challenges related to food safety, losses and waste as measures for the mitigation of food and nutrition insecurity in developing countries.

**Keywords:** Food and nutrition security, food safety, loss and waste, developing countries

Professor Charles Muyanja, Makerere University, School of Food Technology, Nutrition And Bioengineering

**Innovative approaches of building food safety capacity in Africa**

In Africa, there have been several attempts to improve food safety. Many international organizations or bodies such UNIDO, WHO, FAO, GFSI have either supported or conducted several capacity building trainings in food safety with little success in improvement of food safety systems. Most of the African countries do not have reliable food safety and quality assurance systems that conform to international standards. Food-borne illness is still a menace and contributes to disease burden in African countries. These diseases are usually due to failure in food safety systems and lack of food safety culture. Despite these drawbacks, in some African countries, the food sector forms a valuable source of foreign earnings. It is essential to conduct food safety capacity building differently and innovatively to have an impact. Food safety capacity building should be addressed from production to consumption i.e. long the food value chain. This comprehensive and integrated approach is known as ‘farm to fork’ or ‘stable to table’ or ‘boat to throat’; it implies the responsibility of providing safe food to the consumer is shared by all stakeholders along the food value chain. Improved food safety can be achieved through awareness raising programmes involving all value chain actors and partners such as local authorities, government departments, consumer organizations, academia, standard setting bodies, and some nongovernmental organizations. This presentation is highlighting some approaches which can be innovatively be used in African states to build capacity and improve the foods safety.

Chemical safety during processing, packaging and storage
Bruno De Meulenaer
Ghent University, Department of Food Technology, Safety and Health

Food safety, including chemical food safety is a challenge throughout the food chain, from farm to fork. In this lecture, this challenge will be illustrated for three different cases, focusing on respectively processing, packaging and storage using three chemical risks as a case example: acrylamide, migration of mineral oil to foods and mycotoxins in corn. For each of the three examples it will also be illustrated that a chain approach is the only solution to manage these risks.

Acrylamide is a genotoxic carcinogen which is produced as a result of the Maillard reaction between free asparagine and reducing sugars. It is an issue for various food chains, including coffee, cocoa, cereals and potato products. In particular the case of potatoes will be documented. From this it will become clear that not only the agronomic sector and food industry play a role in mitigating the formation of acrylamide, but that also the caterer and the final consumer are crucial in reducing the acrylamide content of fried potato products.

Mineral oils are found throughout the agro-food industry and are typically composed of saturated and aromatic hydrocarbons. The saturated hydrocarbons tend to accumulate in the human body, while the aromatic hydrocarbon fraction may contain genotoxic carcinogens. Mineral oils may migrate to foods from various types of food contact materials, in particular recycled board, thus illustrating a potential conflict between the drive to sustainability and closed loops in the food industry and food safety. As mineral oil may originate also from other sources, awareness with respect to its potential presence and carry over to foods should be increased.
Corn is a staple food for a major part of South-Saharan populations. It is very susceptible for mould infestation, both at a pre-and post-harvest level. Typically, *Fusarium* and *Aspergillus* species tend to infest the corn, leading to contamination with respectively fumonisins and aflatoxins, which are both considered as carcinogens. Postharvest control measures were recently evaluated in a cluster randomised-controlled intervention study in Tanzania. The results showed that locally available post-harvest mitigation strategies were effective and impacted positively underweight in children from the intervention group. Risk management of this mycotoxin issue should not only necessary at the post-harvest level, but requires also pre-harvest measures and a more diversified diet.

Dr. Peter Ogera Mokaya
Click here, for more: http://organicconsumers.co.ke/about-us.html

Organic Farming, Pesticide Use, and Food Safety

This presentation is on Organic farming as a solution to food safety concerns arising from use of synthetic pesticides with a focus on glyphosate, the active ingredient in the commonly use weed killer, Roundup.

But first, what is Organic Farming? Organic farming is an agricultural system that uses ecologically based pest controls and biological fertilizers derived largely from animal and plant wastes and nitrogen-fixing cover crops. Modern organic farming was developed as a response to the environmental harm caused by the use of chemical pesticides and synthetic fertilizers in conventional agriculture. It has numerous ecological and human health benefits. What is Food Safety? Food safety is a scientific discipline describing handling, preparation, and storage of food in ways that prevent food-borne illness. What is food security and how is it related to food safety? Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life” (Mar 19, 2012). What are pesticides? Pesticides are substances that control pests, including weeds. The term pesticide includes the following: herbicides, insecticides, nematicides, molluscicides, piscicides, avicides, rodenticides, bactericides, insect repellents, animal repellents, antimicrobials, and fungicides. There is increasing evidence that “(healthy) food is medicine” and that “unhealthy food causes diseases”…the same “Father of Modern Medicine” Hippocrates, in 431 B.C, is said to have made this less known quote: “ all disease begins and ends in the gut”.

This paper tries to draw a link between organic farming, pesticide Use and food safety. The paper presents evidence that glyphosate, the active ingredient in Roundup Weed Killer, is also a chelator of minerals, an antibiotic and works synergistically with heavy metal residues, harmful bacteria and other antibiotics to increase antibiotic resistance and a myriad of other negative food safety outcomes. Additionally, the paper presents evidence that use of this already unsafe pesticide will increase if GMOs are introduced, further worsening the food safety concern.

Finally, it concludes by presenting Organic farming as one of the solutions to to use of synthetic pesticides use towards achieving sustainable food security and that further local research needs to conducted to validate these food safety findings.

Key words: Organic Farming, Food Safety, Pesticides, Glyphosate, Roundup, GMOs, Antibiotics

Dr. Kepha Ombacho, PhD, FAIPH, MBS

Key note speech

Food safety is important in achieving Sustainable Development Goals on Zero hunger; Good Health and Well Being; Responsible consumption and production; and Enhancing Partnerships. Access to safe food is a human right and both Article 43(1)(c) and (d) of the Kenya Constitution and the Health Policy, 2014-2030 prioritize food safety and nutrition.

Unsafe food is a threat to human health with more than 200 diseases being spread through contaminated food and 420,000 deaths due to foodborne diseases. Kenya has experienced the burden of consequences of unsafe food including cholera outbreaks, aflatoxin poisoning, high cases of typhoid fever and the raising cases of emerging non-communicable diseases like cancer. Unsafe food is also a threat to economies and also damages global trade leading to further food waste, which can no longer be tolerated in a world where many still suffer from hunger. Zoonotic diseases, veterinary drug residues, Aflatoxin M1, hydrogen peroxide and formalin are some of the most common hazards that occur along the meat and dairy value chains making the products unsafe. The presence of pesticide residues in fruits and vegetables in our domestic market is an issue of concern with regards to heavy metal
contamination leading to negative health implications to the consumer. Unsaturated fats (hydrogenated vegetable oils) are associated with raised cholesterol levels thus increasing the risk of heart diseases and Type II diabetes.

The national food safety system in Kenya is managed by various agencies under different ministries and laws. This is with an ultimate aim of promoting public health, protecting the consumer against health hazards and enhancing economic development. Each agency operates independently to fulfill the function for which it was established. However, the activities at each level require integration into a coordinated system. This necessitated the formation of the National Food Safety Coordination Committee. The Chair is with the Ministry of Agriculture, Livestock, Fisheries and Irrigation while the Ministry of Health is the Secretariate.

There is still a need for the establishment and maintenance of a rational, integrated farm-to-fork food safety system that harmonizes inter-agency efforts, minimizes inter-agency conflict and overlaps, and ensures the protection of public safety in a manner consistent with the Sanitary and Phyto-sanitary Agreement of the World Trade Organization (WTO/SPS) and other international requirements.

Let us all be part of the global effort of transforming the world and the realization of the Sustainable Development Goals and its targets.

**Biotechnology, Genetically Modified foods and food safety**

Hamadi Iddi Boga PhD  
*PS State Department of Agricultural Research*  
*Ministry of Agriculture, Livestock, Fisheries and Irrigation*

Genetically Engineered crops are also referred to as Genetically Modified organisms (GMO). All crops are Genetically Modified constantly through natural mutations, natural hybridization and genome duplication. Scientists in their breeding process apply selective breeding to improve crop quality and quantity to produce new plant materials. Foods produced from or using GM organisms are often referred to as GM foods.

Genetically modified (GM) foods also known as biotech foods that are developed from genetically modified organisms. GM crops are the crops whose DNA has been modified using genetic engineering techniques with the aim of introducing a new trait to a plant which does not occur naturally in the species. Food and nutritional benefits of genetic engineering techniques is to introduce specific changes made in the DNA of these crops that encourage faster growth and ability for disease resistance, salinity resistance, drought tolerance, herbicide resistant, nutrition availability to meet the growing demand of the population and food security. Almost in every area in the food production GM foods are developed and marketed because there is some perceived advantage either to the producer or consumer.

This paper evaluates food safety in relation to biotechnology, genetically modified foods and food safety considering the consumer health, education and food safety. The primary concern of the public on GE food crops is whether the newly expressed protein(s) represent new risks of food allergy or toxicity due to insertion of the new genetic material into the host genome. Recent scientific data demonstrate that the process of genetic engineering does not, in itself, create new types of risks. Hazards are present in nature, and some are associated with conventional food crops for instance, solanine, a glycoalkaloid with limited toxicity in potatoes and tomatoes.

This paper highlights common areas of public concerns, guidelines and standards for GM foods safety assessment and recent scientific studies supporting safety over 20 years. Also discussed are data of testing food and feed products from insect resistant, herbicide tolerant and stacked traits of previously approved single traits, and other types of GE crops in laboratory and livestock animals and over 18,000 publications have shown that the technology used to produce them is not inherently hazardous. No adverse effects have been observed to date.
MALNUTRITION CHALLENGE IN KENYA
A third of the Kenyan population is affected by food insecurity which can contribute to chronic malnutrition. This public health challenge is further exacerbated by underlying causes including poor maternal health/child care practices, lack of access to healthy, diverse foods, and inadequate health services. The rate of diet related non-communicable diseases, such as cardiovascular, diabetes, cancer, kidney and liver complications, continues to rise in Kenya. These conditions are the result of diets that are low in fibre and high in sugar, fats, and salt.

GAIN’S CONTRIBUTION
Driven by the vision of a world free from malnutrition, GAIN’s purpose is to advance nutrition outcomes by improving the consumption of safe and nutritious food for all people, especially the most vulnerable to malnutrition by increasing desirability, availability and affordability of Nutritious foods.

Our work to improve the consumption of safe and nutritious foods is based on:

1. Increased consumer demand for safe and nutritious foods which focuses on:
   a. Consumer education
   b. Support to businesses to support their workforce nutrition

2. Increased accessibility of safe and nutritious foods which focuses on:
   a. Strengthening the supply chain for safe and nutritious foods
   b. Technical assistance to SMEs and large businesses to improve business, product innovation and development and marketing that increase supply of safe and nutritious food
   c. Financing and financial linkages for business

3. Strengthened enabling environments for designing, implementing and scaling up effective programs
   a. Support to national and county government to provide policy guidance and implement frameworks that make it easier for businesses to supply safe and nutritious food

GAIN has been working to help improve the nutritional status of Kenyans since 2010, with an initial focus on supporting the Government of Kenya to introduce the fortification of maize flour, wheat flour and edible oils, which is now mandatory. Since then, working in alliances with partners, we have made fortified staple foods available by supporting over 20 large scale millers; reached over 350,000 children aged 6-23 months with micronutrient powders; worked with over 60 food businesses to increase their ability to improve consumers’ access to nutritious diets. We have also worked extensively to increase awareness among vulnerable populations, in different parts of the country, on why and how to access healthy diets for themselves and their families.

OUR PROGRAMMES
Marketplace for Nutritious Foods: Funded by the Ministry of Foreign Affairs of the Netherlands, GAIN has worked directly with local businesses to ensure production and supply of nutritious foods to low income consumers. Throughout the project lifetime, over 30 companies have been supported with grant and technical assistance to increase availability and affordability of various nutritious foods while more than 40 small and medium scale companies have received capacity building in Nutrition principles, Standards and compliance, Food safety and entrepreneurship. Previously, from 2012 to 2017, the project was funded by the USAID where 17 companies were supported through technical support and funding while over 50 were provided with capacity building through multiple day training.

Nutrition for Tea Farming Families: This project, also funded by the Dutch Government and christened “TEAFAM”, is aimed at improving diets among smallholder tea farmers in Kenya. In partnership with Kenya Tea Development Agency (KTDA), the intervention targets approximately 35,000 smallholder farming families and indirectly over 175,000 people in four KTDA managed factories (Chinga, Litein, Kapkatet and Mogogosiek). The project addresses demand and enabling environment of Nutritious Foods through;
- Social behaviour change communication
- Advocacy: Engaging the private sector in recognizing the importance of good nutrition and the need to support their supply chains with nutrition sensitive interventions.

In the short-term, we aim to increasing demand and access to safe and nutritious foods amongst the tea farmer families in Kenya. Ultimately, GAIN aims to enable businesses to improve the nutrition of their workforce. It is expected that evidence generated through this project may assist in guiding the global tea sector to invest in interventions that improve the nutrition and livelihoods of their farmers and create an opportunity for sector transformation for improved nutrition through buyers, buyer umbrella organizations and policy changes. A previous project dubbed “Seeds of Prosperity” on nutrition and hand-washing and implemented by GAIN in partnership with Unilever and the Sustainable Trade initiative (IDH) reached over 14,000 beneficiaries in Kericho.

**Sun Business Network (SBN):** Through SBN, GAIN aims to strengthen enabling environments for designing, implementing and scaling up effective programs. SBN Kenya is the private sector branch and is the only neutral platform to broker partnerships and collaboration between food businesses along the entire value chain and all nutrition actors at national and county levels. SBN’s aim is to build the case for greater business engagement amongst all nutrition stakeholders and support food businesses in finance, technical assistance, advocacy, market and demand and workplace nutrition.

**Advocacy for Large scale food fortification:** GAIN has been working on advocacy for large scale food fortification within the counties and currently focusing on Nairobi and Nakuru counties and soon to Kiambu, Mombasa, Uasin Gishu, Kisumu and others. The objectives of this fortification campaign include: influencing policy dialogues to include debate and declaration to support large scale food fortification, influencing budgetary allocations towards enforcement, establish fortification champions at the county and national level; and ultimately fill the knowledge gap on nutrition and food fortification.

**Commercialization of Biofortified Crops:** In 2018, GAIN and HarvestPlus entered into a partnership to accelerate progress in improving access to essential vitamins and minerals for vulnerable people, through the commercialization of biofortified crops. Starting this year (2019) the partnership is working to design programs to expand coverage of biofortified nutrient dense foods to millions of consumers in six targeted countries where malnutrition is most pervasive. In Kenya, the focus for these commercialization efforts will be high Iron beans.
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TechnoServe helps grow strong markets that create income, jobs and wealth for poor people in the developing world. Our programs:

• **Develop Capacity**
  We help individuals and communities acquire skills, share knowledge and apply the technologies needed to build successful farms and businesses.

• **Strengthen Market Connections**
  We coordinate among industry players and connect emerging businesses and farms to the necessary capital, networks, and suppliers to help them grow their businesses.

• **Improve the Business Environment**
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• We bring private-sector experience to development work through teams that combine business expertise with local knowledge, relationships, and context.

• We work as a catalyst at all points in competitive markets, partnering with stakeholders including smallholder farmers, governments, donors and multinational corporations.

• We specialize in leveraging corporate partnerships to create shared value for all market participants.

TechnoServe is fostering competitive businesses that generate jobs and income opportunities across the developing world.

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  of beneficiaries were women or women-owned businesses

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LASTING CHANGE
Since 1968, TechnoServe has helped to improve the lives of millions of people. The examples highlighted below show how our work can catalyze inclusive economic growth.

KENYA
For more than 40 years, TechnoServe has been working in Kenya with farmers, cooperatives, suppliers, and processors to strategically develop competitive industries around key agricultural markets, including coffee, dairy, and horticultural products. We are helping farmers improve agricultural practices, assisting producer organizations to strengthen operations and identifying opportunities for investment in agriculture. Additionally, we are supporting the diversification of Kenya’s economy through entrepreneurship programs that empower young women and men to create thriving businesses.

The Strengthening African Processors of Fortified Foods (SAPFF)
The Strengthening African Processors of Fortified Foods (SAPFF) project takes a holistic approach in supporting food companies in the production of safe and high-quality fortified foods. The project is working with the public and private sector in Kenya, Tanzania, and Nigeria to increase access to safe and nutritious foods by working to strengthen a competitive and profitable food industry.

SIMA project
SIMA project with funding from Nutrition International that works on building relationships with medium and small scale maize millers and industry stakeholders to identify capacity building needs towards improving industry compliance to the mandate fortification standards.

The Alliance for Inclusive and Nutritious Food Processing (AINFP)
The Alliance for Inclusive and Nutritious Food Processing (AINFP) is a USAID Feed the Future funded program which aims to increase the competitiveness of the food processing sector. In alliance with Partners in Food Solutions (PFS), we provide technical assistance, expertise, and business advisory services to help African food processors grow their business, create jobs, increase the availability of nutritious food, and expand markets for local farmers. We link these processors to employee volunteers from PFS’ member companies – General Mills, Cargill, DSM, Bühler, The Hershey Company, and Ardent Mills – who apply their expertise to address the manufacturing and business challenges that limit their growth. Our core programming is complemented by support activities to deepen local sourcing from smallholder farmers, expand firms’ distribution channels to the bottom of the pyramid, and broaden access to finance.

JOIN THE MOVEMENT
African food processors hold the key to strong and healthy communities.
Join the movement # FortifyingAfrica
To learn more, contact: Rizwan Yusufali, Regional Program Director, Strengthening African Processors of Fortified Foods (SAPFF) ryusufali@tns.org
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Malnutrition in Kenya continues to be a public health concern with negative implications on the economy, social and cultural life of its citizens. The 2014 Kenya Demographic Health Survey reported high protein-energy malnutrition with 26% of children being stunted, 11% being underweight and 4% of wasting (KNBS, 2014). Similarly, the national micronutrient survey conducted in 2011 revealed worrying micronutrient deficiencies. Folate deficiency was found to be at 32% in pregnant women, posing a risk of neural-tube defects to unborn babies. About two third of children were found to be either Vitamin A deficient or within the margin of deficiency, 26% were anemic and 22% of them were Iron deficient. Zinc deficiency was found to be predominantly high across the entire population (KNMS, 2011).

The Government of Kenya, through the Ministry of Health has explored various High Impact Nutrition Interventions to address malnutrition. Food fortification has been recognized as one of the most cost effective interventions that can register health outcomes within a short time. It refers to the practice of deliberately increasing the content of essential micronutrients in food so as to improve its nutritional quality and to provide a public health benefit with minimal risk to health. The history of fortification in Kenya dates back to early 1970's with salt iodization which resulted to a remarkable decline in goiter rates. Based on the success stories for salt iodization, food fortification in Kenya evolved to include other food vehicles (maize flour, wheat flour, fats and oils). In 2006, the food fortification logo was developed. Food fortification in Kenya is implemented through Ministry of Health under the Nutrition and Dietetics Unit. However, in 2006, the Ministry of Health established the Kenya National Food Fortification Alliance (a private-public partnership that brings together all the key stakeholders in fortification) to spearhead all works relating to food fortification in the Country.

In order to make fortification impactful, Kenya made fortification of wheat flour and maize flour mandatory through an amendment of the Food, Drugs and Chemical Substances Act of the Laws of Kenya CAP 254, Notice No 62 of June 2012. This regulation was further revised to include fortification standards through the legal notice number 157 of 24th July 2015 which states in part: Packaged wheat flour and dry milled maize products shall be fortified and conform to food requirements specified. It is expected that this will complement other ongoing initiatives and deliver quick gains towards universal health coverage.

Key words: Fortification, Intervention, fortification standards

Current levels of compliance of commercial wheat flour brands to the national fortification standards in Kenya

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**Background:** Food fortification is a suitable strategy to combat micronutrient deficiencies which affects over a third of the global population. The Kenyan government recognizes and appreciates the role food fortification plays in providing essential nutrients that are vital for maternal and child survival, and has put in place strategies to address micronutrient deficiencies. Wheat flour is a suitable vehicle for food fortification in Kenya since it is widely consumed hence its wide coverage in all the socioeconomic classes among Kenyan population. However, even with mandatory wheat fortification in Kenya, micronutrient malnutrition such as iron, zinc and vitamin A still exists. This could suggest inadequate intake of micronutrients from foods. This might also raise questions on the effectiveness of the national food fortification program. **Problem statement:** Low/ non-compliance to foods fortification standards is identified as one of the main challenges encountered in the effective implementation of fortification programs. In Kenya data on the level of compliance of fortified wheat flour to the national standards is scanty making it difficult to determine the coverage and safety of fortified flours. **Objective:** To determine the level of compliance of commercial wheat flour brands to the Kenyan fortification standards. **Methodology:** Sampling of market brands of wheat flour was done randomly in Nairobi region of Kenya. The samples were picked from retail stores and analysis of 8 micronutrients (iron, zinc, vitamin A, all B vitamins except B12) was carried out. Analysis was done using standards procedures and the level of compliance determined based on the fortification
standards in Kenya. **Results**: Only 4 samples complied to the national standards for at least 3 of the micronutrients mandated for fortification which indicated a compliance level of 33.33% from the 12 samples analyzed in Nairobi region. Considering all the samples, the compliance level per micronutrient was 100, 83.3, 41.7 and 8.3% for iron, vitamin B₃, B₆ and B₉ respectively. None of the samples had zinc, vitamin A, Vitamin B₁ and B₂ within detectable limits. This indicates that the compliance for wheat flour fortification is low within Nairobi region.

**Keywords**: Compliance level, wheat flour fortification, micronutrient deficiency, fortification standards, fortification programs

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**The Status and Safety of Maize Flour Fortification in Kenya**

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**Background**: Maize is the most widely consumed staple food by the Kenyan population. In 2012, to reduce the prevalence of micronutrient deficiencies in the population, the government enacted a mandatory legislation for maize and wheat flour fortification. Despite this effort, the inclusion of fortification as part of routine milling process has remained a major challenge and most millers have no knowledge or capacity to run safe food fortification processes. This has been exaggerated by the decline in maize production and the related safety issues from production, storage, processing and use. **Methodology**: A study was carried out to determine the compliance status and safety of fortified maize flour brands in Kenyan markets. The survey tool contained information of milling characteristics, level of training of employees, food fortification implementation, and food safety issues. A total of 27 brands were procured from the market to check compliance status of each brand to the national standards. **Results**: A total of 78 mills were surveyed including 22 large-scale, 25 medium-scale and 31 small-scale mills. Most of the mills used roller milling technology except at small scale level where about 14% hammer mills were used. Despite the large diversity in number of employees, over 52% of the mills had less than 20% trained personnel. All the large-scale mills implemented flour fortification programs, while the practice among medium and small- scale maize mills was implemented at 45.8% and 24.1% respectively. There was evidence of weak quality management systems for production of fortified maize flour. Only 10% of all the mills had integrated food fortification in their quality control and quality assurance systems. The level of compliance of fortified maize flour to national standards was low with only 11.1% of the samples complying in the micronutrients (vitamin B₂, B₃, B₉, vitamin A, zinc, and iron) analyzed. Compliance status for specific micronutrients to national standards varied greatly. Minerals had higher compliance levels than vitamins. About a fifth (18%) of the samples from the market did not comply for any micronutrient analyzed. **Conclusion**: There was evidence of low adoption of fortification programs and compliance, and safety gaps in the maize milling industry. There is, thus, need for concerted effort toward strengthening the safety and maize fortification practices in the country.

**Keywords**: Fortification; compliance; maize flour; maize mills; mill characteristics

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**International Livestock Research Institute (ILRI)**

**Less is more: household milk allocation response to price change in peri-urban**

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**Introduction**

Low income households in Kenya depend on informal dairy sector to access raw milk and meet their nutrients needs. This is because raw milk is cheaper than processed milk by 20 – 50%; majority prefers its taste and high butterfat content; it is widely accessible; and it is sold in variable quantities suiting every consumer’s affordability. Despite the critical nutritional role played by the informal dairy sector on poor households, the need to conform to international standards of food safety has triggered regulatory agencies to formulate policies that restrict informal
commercialization of milk. While promoting milk pasteurization is an important public health measure, little is known of its potential effect on household milk consumption and allocation. **Methods:** We conducted an experimental study to investigate the effect of milk price increase on intrahousehold milk allocation to children (less than 4-year-old) in peri-urban settlements in Nairobi that would result from elimination of the cheaper informal milk from the market. The study entailed a best-worst choice experiment that posed various hypothetical scenarios, each with four milk allocation alternatives for the respondent to pick the most and least likely choices they would take in the event milk prices increased by 40% from the prevailing retail price. We analyzed the relative importance of milk allocation alternatives and used latent class model to examine the likely impact of such policy on children milk allocation in different groups. **Findings and interpretations:** Of all the 9 milk allocation alternatives, 4 were the most important/preferred regardless of the household socioeconomic and demographic characteristics and these suggested that an increase in milk price by 40% would decrease overall milk demand and consumption at the household level. Moreover, in three of those, the choices that households consider best/most likely directly affect the amount of milk allocated to children below the age of 4 years. Although participants indicated that they would compensate for the decreased milk amount allocated to children by substituting with another food item, the nutrition value of the replacement, taste and preference, complementarity and price among other factors might not match that of milk. **Conclusions:** Poor households prefer consuming raw milk sourced from the informal sector due to its relative affordable price, taste and its accessibility. Increasing price would likely decrease household demand as there would be overall decrease on the amounts consumed by its members — including children. Given that the current consumption is below the amounts recommended by WHO, policies streamlining the dairy sector should consider the large informal sector as strategic partner and strengthen its capacity to market safe milk in an overarching goal of improving consumption instead of eliminating it.

**Risky assumptions: The impact of household practices on raw and processed milk safety**

*Vivian Hoffmann, International Food Policy Research Center (IFPRI), Sheillah Simiyu, African Population and Health Research Centre; Meng-Hsien Tsai, University of Iowa; Vivian Hoffmann, International Food Policy Research Center; Kelly Baker, University of Iowa*

**Background:** Common weaning foods – particularly cow’s milk – are a leading cause of foodborne pathogen transmission to infants. New regulations proposed by the Kenya Dairy Board focus on curtailing the sale of raw milk, in which high levels of microbiological contamination has previously been shown. **Objectives:** To assess the pathogen contamination of milk given to infants at 9 months of age, to compare contamination by type of milk (raw, fresh pasteurized, long-life), and to assess the influence of market milk quality and household practices on infant food safety. **Methodology:** Paired milk samples were collected at point of purchase (morning or evening) and at the subsequent afternoon feeding from approximately 300 households in low-income peri-urban Kisumu. Conventional microbiology and quantitative polymerase chain reaction (qPCR) methods were used to identify pathogens in these samples. Rates of contamination were compared across milk types (raw, fresh pasteurized, long-life), and contamination with specific pathogens were compared at point of purchase versus point of consumption for paired samples. **Results:** The rate of presumptive pathogen contamination at purchase was highest for raw milk, but significant shares of pasteurized and UHT milk were also found to contain potential pathogens at purchase. Contamination rates increased between purchase and consumption for fresh pasteurized and long-life milk and decreased for raw milk. PCR validation analysis of presumptive *Salmonella spp.* colonies identified through culture-based analysis, completed on a subset of the samples to date, confirms over 50% are *S. enterica* serovar *typhi*. **Conclusion:** Pathogen contamination in processed fresh and long-life milk indicates hygiene failures in the cow milk processing and/or supply chain in Kenya. Household milk handling practices reduce (but do not eliminate) contamination in raw milk and increase contamination in processed milk. There is a need for consumer education on safe milk handling, particularly with respect to processed milk.

**Mycotoxin binders: An option for safer milk in Kenya?**

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**Background:** Aflatoxins are a recurring problem in Kenya, and levels exceeding the recommended limits have been documented in both human food as well as animal feeds. Consumption of products contaminated with aflatoxins...
can have serious health effects, including liver cancer from chronic exposure. Aflatoxins also cause problems in livestock production, with animals producing less, and there are also concerns about aflatoxins in the animal products, especially dairy products. Aflatoxin M1 (AFM1) is found in milk from cows fed on diets contaminated with aflatoxin B1 (AFB1). In order to protect milk from getting contaminated, milking cows should not be fed too high levels of aflatoxins. Binders are mixed with feed, and when ingested, sequester the toxins in the gastrointestinal tract of the animal. Bound toxins are eliminated in faeces and their bioavailability is reduced. As a result of this, the animal is protected from possible negative effects and safer milk is produced. **Objective:** We provide a discussion on the potential of mycotoxin binders in addressing the problem of aflatoxins in smallholder dairy systems of Kenya. **Methodology:** Our discussion is based on what is available in literature, visits to selected agrovet and animal feed outlets, and lessons learnt while implementing a pilot to assess binder use in the field. **Results:** A summary of mycotoxin binder types available in Kenya is given and a highlight of constraints to their current use is provided. We also give suggestions on what can be done to promote their use by smallholders across the country. **Conclusions:** Mycotoxin binders are an option for reducing aflatoxin concentration in cow milk. Sustainable marketing channels need to be explored as more research is done to characterize their effectiveness in smallholder systems.

**Consumers do care! Incentivizing microbiological food safety in informal markets in sub-Saharan Africa by leveraging consumer demand**

Kristina Roesel1-2; Marcel Zwietering3; Coen van Wagenaer4; Arie Havelaar4; Silvia Alonso5; Ralph Roothaert5; Gemma Tacken6; Ruurd Ruben6; Kebede Amenu7; Laurencia Ouattara8; Johanna Lindahl9; Srinivasan Ramasamy9; Michelle Danyluik10; Michel Dione11; Yitagele Terefe12; Tadesse Guadu13; Vianney Tarpaga14; Daniel Kaboré15; Birhanu Megersa Lenjiso16; Delia Grace Randolph1

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**Background:** Informal markets are vital to food and job security across many low- and middle-income countries (LMIC). There is emerging data on microbiological food safety hazards and risks along food supply chains that allow targeting mitigation options. Efforts include training in better practices and technologies, but these have mostly targeted production, neglecting the market-based processing and retail level, where much cross-contamination occurs, exposing the final consumer to risk. Poor practices are largely due to a lack of knowledge and appropriate technology but also lack of incentives to change poor practices. Previous studies have shown that even poor consumers do care about the safety of their food but have no alternatives in the market or little power to demand for safer food. **Objectives:** This four-year project (2019 to 2022) investigates if consumer demand can provide the same incentive or “pull approach” for microbiological food safety in LMIC as it has done in high-income countries. It also builds capacity of value chain actors to respond to demand and of regulators to provide an enabling environment (the “push approach”). At the same time, it strengthens food safety capacity at national level through generating evidence on the national burden of foodborne diseases and selected hazards and risks in chicken, meat and vegetables. **Methods:** The project is organized in seven technical work packages: 1) Estimating burden and cost of key foodborne illnesses in Burkina Faso and Ethiopia; 2) Understanding the poultry and vegetable value chains in urban markets in Burkina Faso and Ethiopia; 3) Quantitative microbial risk assessment and cost-effectiveness analysis of candidate market-based interventions; 4) Build capacity and motivation of regulators to manage food safety (intervention 1, push approach); 5) Empower market-level value chain actors to manage food safety (intervention 2, push approach); 6) Design and implementation of a consumer campaign (intervention 3, pull approach); 7) conduct an impact assessment of the push-pull intervention. **Expected results:** Investments that improve public health are considered highly rewarding. With this project we aim to achieve measurably safer food, credentialed capacity in regulators and value chain actors, improvements in knowledge and practice among value chain actors, and improvements in food safety awareness and practices among consumers.
Background: Aflatoxin is endemic in developing countries given the ideal environment for aspergillus growth especially in the arid and semi-arid areas. Cereal based foods and animal products like milk make up the majority of food consumed by children under 5 years and pregnant and lactating mothers. Despite strict regulations on the allowable limits for aflatoxin contamination in foods, loopholes in implementation has led to exposure of the toxin leading to undernutrition. Aflatoxin exposure causes liver cirrhosis and liver cancer, immune-suppression, poor nutrient absorption and metabolism and stunting among children in utero, during breastfeeding and complementary feeding. Objective: The objective of this review is to analyze the consequences of aflatoxin exposure intrauterine, through breastmilk and complementary feeding to the nutrition status of young children. Methodology: A systematic review was conducted in PubMed database. The key terms used in the search were; aflatoxin exposure, malnutrition. Data was summarized in to themes to establish effect of aflatoxin exposure. Findings: Aflatoxin exposure levels as high as 480 μg/kg have been reported. Although acute toxicities have been reported, chronic exposure is reportedly high among children. Intrauterine and breast milk exposure to aflatoxins and subsequently during complementary feeding have been associated with micronutrient deficiencies, poor growth and development among children. In the reviewed papers, there is a strong effect of aflatoxin exposure to low gain of height for age in children younger than 5 years. Aflatoxin exposure is also associated with low vitamin A and zinc levels and poor protein metabolism. High maternal aflatoxin levels during pregnancy leads to poor growth of children in the first year of life. Conclusion: This review shows that aflatoxin exposure is of public health concern as it affects growth, vitamin A and zinc deficiency can potentially lead to a despite the active interventions to reduce stunting, Vitamin A deficiency and child mortality exacerbated by high levels of malnutrition. Recommendation: There is need to design effective interventions aimed at reducing aflatoxin exposure among children below 5 years. Better monitoring and surveillance of aflatoxin in foods will also contribute significant reduction on exposure.

Key words: Food security, food safety, health promotion, malnutrition and hidden hunger.
ST1-3-001S: Salmonella typhimurium Impairs Absorption of Nutrients and Induces Inflammation via Type 3 Secretion Systems (T3SS): A Recent Review

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Background: Crossing the epithelial cells is crucial for pathogenesis of most food pathogens such as Salmonella spp, which is the leading cause of foodborne deaths globally. Whereas substantial data has attributed impaired absorption of nutrients during food borne illnesses to vomiting and diarrhea, Salmonella typhimurium uses type 3 secretory systems from the pathogenicity islands 1 and 2 to degrade Salmonella spp. (11%) being the leading causes of food borne illnesses. Non typhoidal Salmonella spp. (28%) is the leading cause of death while norovirus (11%) led to the least deaths. These figures suggest that Salmonella spp. possess a big threat in terms of food borne illnesses and more efforts should be geared towards understanding its mechanism of pathogenesis including virulence factors and its translocation via the epithelial membrane to the host defense mechanism.

Objectives: The main aim was to explore recent findings on how Salmonella typhimurium disrupts the epithelial cells and tight junctions, and ultimately triggering inflammation. Methodology: This review was completed through searching of relevant articles in BMJ database, Google Scholar, NCBI Bookshelf, PubMed and PubMed Central databases. The key words used in the search include Salmonella typhimurium, cytokines, tight junctions, epithelial cells, type 3 secretory system and Salmonella spp. A total of 26 articles were downloaded, read and included in the review. Abstracts of the articles were read and the ones found fitting the criteria for the review were downloaded and the whole paper read. Only those papers that answered the research question were included in the review. Results: Evidence from the reviewed articles showed that Salmonella disrupts the epithelial membrane by binding to the mucin cell surface particularly neutral mucins, and subsequent damage to epithelial tight junctions’ proteins. Alternative mechanisms for Salmonella pathogenicity are through secretion of exopolysaccharide which enables it escape destruction by host antibodies; and via effector protein AvrA which can induce inflammation via production of pro-inflammatory markers lipopolysaccharide (LPS) and interleukin-8 (IL-8). Conclusion: Understanding how Salmonella interacts with epithelial surface would be important for public health professionals interested in delivering nutrients and managing patients infected with the pathogen.

Key words: tight junctions, type 3 secretory system, Salmonella spp. epithelial cells

ST1-4-001S: Effectiveness of the post-harvest interventions to minimize the risk of aflatoxin and fumonisin contamination in maize and subsequent dietary exposure in Tanzanian infants: a cluster randomized controlled trial

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Background: In Tanzania, maize, a crop susceptible to mycotoxin contamination, is the staple food and main ingredient used for preparation of complementary food. With the increasing evidence that mycotoxins (especially aflatoxins and fumonisins) can exacerbate the effects of under nutrition and contribute to growth faltering, it is likely that mycotoxin exposure has inhibited the expected growth improvement predicted for nutritional intervention programs. Objective: The study aimed at evaluating the effectiveness of locally available post-harvest mitigation strategies in preventing and reducing aflatoxin and fumonisin contamination in maize. Methodology: In 2013, a cluster randomized controlled trial was performed in three agro-ecological zones of Tanzania. A total of 300 children, each from one household, were randomly selected from 30 villages (intervention: n= 15). The mitigation strategies focused on hand sorting (prior to storage and use), drying maize on mat/raised platforms, proper sun drying, application of insecticides during storage and de-hulling before milling. Maize sample was collected from each household at harvest and six months after harvest. Maize intake by each child, estimated using 24h dietary recall technique and body weight measured using standard procedures, were taken at six months after harvest. Aflatoxins and fumonisins in the maize samples were determined using...
Ingestion of Food containing Arsenic, Cadmium, Chromium and Lead in Fluorspar Mining Belt Elgeyo-Marakwet County, Kenya

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Cancer is currently one of the leading causes of deaths globally. Ingestion of carcinogenic heavy metals through contaminated foods has some likelihood of contributing to the cancer burden. Milk, water and commonly consumed cereals in Fluorspar mining belt of Kimwarer sub-catchment area in Elgeyo-Marakwet County were collected and the concentration of Arsenic (As), Cadmium (Cd), Chromium (Cr) and Lead (Pb) was determined. Health risks were evaluated by estimating daily heavy metal intake and computing cancer (Incremental Lifetime Cancer Risk) and non-cancer risks (Target Hazard Quotient) using probabilistic risk assessment model of US-EPA. Heavy metals in the cereals, soils, milk and water varied with seasons, sites (zones) as well as metal types. Higher daily intake of As, Cd and Pb was observed from the consumption of water and millet. In addition, the probability of an adult developing cancer from the consumption of studied cereals, water and milk was greater than US-EPA threshold risk limit (ILCR>10⁻⁴) for As, Pb and Cd. It suggests that the study area poses a potential risk to the local inhabitants through consumption of studied cereals, milk and water. Consequently some effective measures may be necessary to curb heavy metal concentration in the soils. There is an urgent need to determine how the community will consume water, milk and cereals within safety levels through comprehensive studies, policy development and enforcement.

Key words: Mining, Heavy metals, Cancer risks, food

ST1-5-002S: Effect of Maternal Aflatoxin Exposure through Diet on Growth of Infants 0 - 3 Months in Kisumu County, Kenya

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Aflatoxins are naturally occurring carcinogenic toxins associated with poor growth outcomes in young children. Although evidence supports mother to infant exposure during pregnancy and breastfeeding, evidence of its effect on growth is limited to the period after introduction of complementary foods. It is therefore unclear whether early maternal exposure to aflatoxin affects infant growth right from birth. Prevalence of aflatoxin levels of 40% has been observed in Nyanza region, and 22.7% of children under 5 years are stunted. The main objective of this study was to determine the effect of maternal aflatoxin exposure on growth of infants 0-3 months old in Kisumu County, Kenya. Out of 553 pregnant women who were screened for aflatoxin exposure, 137 exposed and 137 non-exposed women, matched for age and household income, participated in an 8-month cohort study. The women were followed up to delivery and their infants up to 3 months after delivery. Infant length and weight data was collected monthly. Length-for-age (LAZ), weight-for-age (WAZ) and weight-for-length (WLZ) z-scores were generated. Aflatoxin levels were analyzed using Enzyme Linked Immunosorbent Assay (ELISA) in parts per billion (ppb). Effects of aflatoxin on infant growth outcomes were assessed using multivariate linear and logistic regression. Effect of maternal aflatoxin exposure on infant length, weight, LAZ, WLZ, WAZ was determined using Cox regression with constant time at risk. Infants of exposed women had lower weight (95% CI:0.85,-0.53), length (95% CI: -4.08, -3.36), LAZ (95% CI: -1.93, -1.16) and WAZ (95% CI: -1.03, -0.54) at 3 months of age, but there was no difference in WLZ (95% CI:0.03, 0.74).
Risk for stunting was higher in infants of exposed women (RR=4.08; 95% CI: 1.35, 12.29). There was no difference in the risk for underweight (RR=6.61; 95% CI: 0.80-54.33) and wasting (RR=0.37; 95% CI: 0.40, 3.39, P=0.38). These results underpin the need to reduce aflatoxin exposure in infants and young children who are very vulnerable.

**Key words:** Aflatoxin, maternal, infant, growth, z-scores, ELISA, stunting, underweight.

**ST1-5-003S: Sources of Aflatoxin Exposure in Kisumu County, Kenya**

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Aflatoxins are naturally occurring group of carcinogenic toxins produced by *Aspergillus flavus* and *Aspergillus parasiticus*. Contamination of foods by aflatoxins is a public health concern in both developing and developed countries because of the effects of the toxins on human health and food safety. It is estimated that about 25% of the world’s food could be contaminated with aflatoxins, giving rise to concerns that if not checked, aflatoxin contamination could impair food security and pose a great health risk to consumers, especially in developing countries. According to WHO, 1.8 million Kenyans consume food contaminated with aflatoxins; and 40% of diets in both rural and urban communities in Kenya are likely to be contaminated by the aflatoxins. Cases of aflatoxin poisoning resulting from consumption of contaminated maize have been reported yearly in Eastern Kenya with several outbreaks of aflatoxicosis, the worst having occurred in 2004. However, data on aflatoxin levels in foods in other parts of the country, and in other foods other than maize, is scanty. Limited data is available on aflatoxin contamination in maize and groundnuts in Homa Bay and Rongo, respectively. The main objective of this study was to establish aflatoxin levels in selected market foods in Kisumu County, Kenya. In a cross sectional survey, 297 solid food samples selected by a combination of cluster and systematic sampling; and 80 milk samples selected from market outlets using the European Model were analyzed for aflatoxin contamination in June-August, 2013. Aflatoxin levels were analyzed using Enzyme Linked Immunosorbent Assay (ELISA) in parts per billion (ppb). Descriptive statistics were used to describe median, IQR and proportions. Aflatoxin B\(_1\) and M\(_1\) levels in market foods ranged between 0 ppb to 34.5 ppb and 0.012 ppb to 0.127 ppb respectively. Sorghum had the highest aflatoxin median levels (median=14.2; IQR=8.5-19). Processed milk, but not raw milk, had samples with aflatoxin M\(_1\) contamination levels above the Codex Alimentarius regulatory limits. Although focus has been on maize and groundnuts, sorghum is a source of aflatoxin exposure and should be included among crops of concern for aflatoxin exposure. Efforts should be taken to reduce potential exposure both from the commonly suspected sources as well as from both processed and unprocessed milk. These results underpin the need to initiate strategies geared towards reducing aflatoxin levels in staple foods consumed in Kisumu County.

**Key words:** Aflatoxin, *Aspergillus*, parasiticus, flavus, sampling, ELISA, parts per billion, exposure, maize, groundnuts

**ST1-5-005S: Inadequate management of complementary foods contributes to the risk of aflatoxin exposure and stunting among children**

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**Background:** Food safety has not been inculcated alongside food choices and preparation at the household level, especially during the period of complementary feeding. Early exposure to aflatoxins through complementary food is linked to stunting. The incidence of stunted growth in children under five years of age is at increasing rate, in developing countries. 

**Objective:** The current study assessed the household’s practices on management of complementary foods in relation to the risk of aflatoxin exposure and poor nutritional status among infant and young children in Tanzania. 

**Methodology:** A cross-sectional study on complementary feeding practices, aflatoxin exposure and nutritional status was conducted among 101 infants and young children aged between 6-23 months in Dodoma region of Tanzania. The intake of complementary food was estimated by using repeated 24 h dietary recall. Flour used as complementary food was sampled from each of the 101 families and aflatoxins were analyzed using high-pressure liquid chromatography. A deterministic approach was used to estimate dietary exposure of aflatoxins in the complementary foods. Anthropometric measurements...
were taken and rates of stunting, underweight and wasting estimated according to the WHO standard procedures. Multivariate logistic regression analysis was used to assess the association between feeding practices and aflatoxin exposure or the nutritional status among subjects. **Results:** The average consumption of complementary flour was 118 g per child per day and 52% of the flours contained groundnuts. AFB1 was detected in 42.5% of the flour and levels ranged from 0.3 to 2,128.0 μg/kg (mean 228.11±49.84 μg/kg). Dietary exposures of aflatoxin B1 ranged from 0.1 to 23,172.81 ng/kg body weight per day (mean 1,337±392.5 ng/kg). Of the subjects, 40.4% (95% CI; 29.8; 50.9) were stunted and significant association was found between stunted growth and dietary exposure of AFB1 (adjusted odd ratio (AOR) =5.9; 95% CI: 0.019-0.028). Additionally, the age of introducing complementary foods (AOR = 13.3, 95% CI, 2.6 – 67.6), maternal education (AOR = 5.5, 95% CI, 1.0 – 9.8) and residence in Chamwino district (AOR = 3.2, 95%, 1.3 – 5.9) were apparently identified as factors associated with stunting. **Conclusion:** Early introduction of cereal-and groundnut-based complementary foods in Tanzania is associated with high risk of aflatoxin exposure and stunting in children. There is need to integrate aflatoxin management measures in the guidelines for Infant and Young Children Feeding of Tanzania.

**Key Words:** Complementary Feeding, Food Safety,
of side effects. To determine the effect food safety and hygiene knowledge on practices among people living with HIV/AIDS. To determine water and sanitation situation and practices among people living with HIV/AIDS. Lastly to determine the relationship between comorbidities, food safety and hygiene and ARVs knowledge and their management. A sample of 133 subjects with 72 from Nakuru and 61 from Thika who used. Data was collected using previously pretested structured questionnaire and a knowledge test by trained enumerators. Data collection was at the meeting places for the PLWHA to keep privacy and quality control. The data was entered in SPSS cleaned and analysed. The results showed that the proportion of PLWHA indicating having had comorbidities such as diarrhoea in the lastone week at baseline was low at 9.5.0% in study site those knowing safety procedures in using ORS few. The proportions with knowledge of hand washing techniques was low and increased significantly with education (p<0.05). The number of known techniques of hand washing studied increased significantly after empowerment p<0.05 The majority 98.4% knew drinking water needed to be safe with majority boiling as water for consumption. However, the most efficient water treatment methods were known by < 50 % of PLWHA. The conclusion was that knowledge in food safety practices and role in comorbidities in HIV was low and may be improved with appropriate health and nutrition education interventions among PLWHA.

**ST1-5-004S: Quantitative Risk Assessment of introduction of Aujeszky's Disease into Kenya through pork importation from Brazil**

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**Background:** Aujeszky's disease (AD), is a contagious, notifiable, economically significant disease of pigs that is endemic in many parts of the world. Causal agent is Suid herpesvirus 1 (SuHV-1). It affects most mammals but only pigs are able to survive a productive infection and are thus considered the natural hosts. AD is an important cause of economic loss in pig husbandry due to morbidity and mortality. Such economic losses may lead to food security challenges. The initiating event for the study was interest of importing pork from Brazil into Kenya. AD virus circulates in feral pigs in Brazil and infections have also been reported in domestic pigs. Since AD has never been reported in Kenya, there is a concern of its being introduced into Kenya through pork from Brazil.

**Objectives:** Study aims: a) To quantify risk of introducing AD virus into Kenya through pork from Brazil; b) To quantify effectiveness of mitigations against AD introduction via pork imports.

**Methodology:** The Quantitative Risk Assessment (QRA) methodology was used to quantify the likelihood of the virus in the pork, its detectability, entry, establishment, and spread within Kenya. The QRA steps were: (a) Hazard (AD virus) identification; (b) scenario tree development, hazard tracking along the product pathway; (c) gathering evidence for each scenario tree step; (d) mathematical function and equation development (e) Performing calculations using Monte Carlo simulations (@ Risk software, Palisade Co.) to determine likelihood of hazard occurrence at each step and overall risk.

**Results:** Overall probability of importing an infected pig into Kenya, after all mitigations designed to intercept/detect or inactivate AD virus in infected pork imported from Brazil has all failed, was 6x10⁻⁶. Thus a maximum of 24 infected pigs would likely be imported into Kenya per year.

**Conclusions:** Risk of introducing AD virus into Kenya through pork from Brazil is negligible, hence, could be managed if appropriate preventive measures are put in place. In summary, mitigation tools in Brazil and adequate inspection at entry ports into the country are effective against AD introduction into Kenya.

**ST1-5-006P: Assessment of Dietary Aflatoxin Awareness and Exposure Levels and Vitamin A Status of Children (6-23) Months Attending Makueni County Referral Hospital**

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**Background:** The high prevalence of malnutrition in developing countries is not only because of inadequate nutrient intake as it is multifactorial. Little doses of aflatoxin consumed over a long period has been shown to cause macro- and micronutrient deficiencies. Small doses of aflatoxin consumed over time have minimal subclinical symptoms compared to the fatal effects of aflatoxicosis resulting less priority given on the reduction of aflatoxin below 10 parts per billion. **Objectives:** To identify the commonly consumed complementary foods and assess the levels of aflatoxin, determine serum aflatoxin M1 and assess vitamin A levels in the children 6-23 months and then establish the relationship between the two variables.

**Methodology:** This will be a cross-sectional analytical
study. Using single random sampling, the mothers of the 279 children selected will be administered with a questionnaire to establish common complementary food, awareness on aflatoxin, prevention and reduction of aflatoxin contamination and vitamin A supplementation and adequacy in the diet. Samples consisting of maize, sorghum and other cereals will be collected from the households and checked for aflatoxin using ELISA method. Blood samples will be collected from the children to check for serum retinol levels using HPLC and urine samples will be collected and tested using ELISA method to quantify aflatoxin M1. Anthropometric measurements (weight, height) will be taken to determine the nutritional status of children. The data collected will be analyzed using SPSS version 22.0. Chi-square with cross tabulations will be used to check the significance between the different proportions and Spearman’s correlation coefficient and regression to assess the strength of relationship between exposure of aflatoxin contamination and Vitamin A status. The findings from the study will be useful to policy makers and other partners in putting in place measures for mitigation of aflatoxin exposure and the possible effect on the nutrition status of children.

**ST1-5-007S: Utilizing Geographic Information Systems in Food Safety Surveillance for Consumer Health and Food Security**

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Majority of food safety studies are in form of summative evaluations and make use of retrospective data which is usually available from medical records and autopsy reports. In addition, the available information focuses on quantitative aspects such as how many persons are affected by various food hazards and how much the government and other stakeholders have used during or require for intervention programmes. The qualitative elements of spatiotemporal mapping to identify where prevalence of specific food safety hazards persist, when their virulence is worst, and what factors exacerbate the situation is however equally important if food products are to safeguard consumer health and ensure food security. In spite of confirmed success of mapping natural resources and socioeconomic issues using Geographic Information Systems (GIS) technology in developed world, most developing countries have been slow in exploiting the technology especially in real-time food safety surveillance. This presentation therefore seeks to discuss opportunities for the use of GIS tools in food hazards’ exposure risk assessment and surveillance in Kenya. The discussion will help in highlighting the importance of geo-information (where, when and why attributes) in food safety management. Partnership between food safety, food security and public health sector players provides opportunities for exploitation of GIS applications in prevention and control of food hazards in Kenya. GIS-based exposure risk assessment and surveillance can be useful in real-time mining, mapping and analysis of food safety data, inspire effective formulation of related policies and legislation, and help to guide holistic consumer health and food security management. The discussion will therefore help stakeholders to consider building and sustaining a working relationship to effectively and efficiently manage food hazards.

**SUB-THEME 2: FOOD SAFETY ALONG THE FOOD CHAIN**

**ST2-1-001S: Fumonisins B₁ (Fb₁) and Fumonisin B₂ (Fb₂) Production Levels In Maize Genotypes Grown in Nakuru County, Kenya**

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**Background:** Maize is a staple food for people in Kenya. It is usually contaminated by fungi especially Fusarium that produces mycotoxins. Fumonisins, is a group of fungal toxins, occurring worldwide in maize infected by Fusarium verticillioides. Most common is Fumonisin FB₁, whose intake above 2mg/Kg body weight/day play a role in Neural tube defect and/or Oesophageal cancer. There is no available data on distribution of different Fusarium species and FB₂ production in various maize genotypes. **Objective:** This study aimed at establishing FB₁ and FB₂ in maize genotypes in Nakuru County, Kenya. **Methodology:** Using purposive sampling, maize kernels showing no symptoms of Fusarium infection were collected from 277 farmers’ stores in Molo and Njoro. Fumonisins (FBs) levels determined using LC-MS. Incidence of Fusarium was established after isolation on PCNB Agar. Identification using colour and spore morphology of Fusarium on PDA was done. **Result:** H624 had 3754μg/kg while Pioneer had lowest 1046μg/kg FB₁ levels. Using correlation analysis, relationship in FB₁ and FB₂ production in various maize genotypes was significant (r = 0.629, P = 0.095) was recorded. Similarly FB₂ levels with % incidence of Fusarium sp. was significant (r = 0.719, P = 0.044). Simple regression showed dependent of % incidence
and Warutere, Petterson2
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Background: The impact of pesticides on human health is of great concern globally despite their usefulness in agriculture. Reported increased use of unspecified pesticides in Mwea irrigation scheme, Kirinyaga County, Kenya justified the need to assess the farmers’ compliance to pesticide use standards and determine pesticide residue levels in tomatoes.

Methodology: Data for this study was collected using a questionnaire from 196 farmers, sampled randomly, who grow tomatoes in open fields and all 5 greenhouse farmers in Mwea Irrigation Scheme. Thirty five tomato samples, 10 from open field farms, 5 from greenhouses, 10 from markets and 10 from consumers were purposively picked and taken to the laboratory for analysis of pesticide residue levels. Analysis was done using QuEChERS Multi-residue analytical method, and their levels compared with EU/ Codex Minimum Residue Levels (MRLs). Results: Over 70% of farmers didn’t adhere to specified pesticide use standards but relied on neighbours and own knowledge regarding the choice of pesticide and rate to use for controlling major pests and diseases such as; leaf miner (Tuta absoluta), mites (Tetranychus spp.), whiteflies (Bemisia tabaci), aphids (Aphids gossypii) and blight. Pesticides mainly used, such as Coragen, duduthrin, oshothane and evisect were toxic WHO class II. Twelve pesticide residue levels were detected in 19 (54%) out of 35 samples analysed. Carbendazim, which is carcigenin, was detected in 9 out of 19 (47%) samples, mostly in tomatoes from consumers. Pesticide residues whose levels were higher than the EU/Codex MRLs were Acephate (0.0321 mg/kg) from the market, malathion (0.0315 mg/kg) from open field farms, carbendazim (1.2341 mg/kg), and thiamethoxam (0.3736 mg/kg) from greenhouses. Conclusion and recommendations: Detection of pesticide residues in tomatoes from farm to consumption level, some at higher levels than the EU/ Codex MRLs could be attributed to application of toxic pesticides, and at higher rates than stated, and harvesting tomatoes earlier than the specified withholding period. The health of consumers who eat these tomatoes daily in the diet and raw as salads is compromised. These findings highlight the need for regular training to improve farmers’ knowledge on pesticide use and frequent monitoring of residue levels to enhance safety for the consumer.

Key words: Compliance, pesticide, residue, consumer, health, safety

ST2-1-003S: Acute Toxicity of the Aqueous Plant Extract of Eragrostis Tremula (Teff)

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Acute Toxicity of the Aqueous Plant Extract of Eragrostis Tremula (Teff) was conducted in laboratory condition. The plant was collected at Tangaza Local Government Area, Sokoto State. Plant was dried at room temperature, grinded and sieved to fine powder. Using OECD guideline for limit test, the test was carried out in two phases. In the first phase, five female Albino Wister Rats of average weight 164kg and after acclimatization for 2 weeks fasted for 3 hours, each is administered 2000mg/kg using oral cannula observed for signs of toxicity for 3 to 4 hours after administration. The second phase include another five albino Wister rats of average weight 164kg and after acclimatization for 2 weeks fasted for 3 hours, each was administered 5000mg/kg using oral cannula. No mortality in animals at all doses of extracts up to 5000mg /kg. The absence of death at doses up to 5000 mg/kg of crude extract showed that LD50 of extracts of E. tremula is greater than 5000mg/kg; calmness was the only behavioral signs of toxicity shown by the animals, these disappeared within 24 hrs of extracts administration. The acute toxicity study of aqueous extract of E. tremula at doses of 2000 and 5000 mg/kg showed no signs of toxicity on hematological or histological parameters. Results showed that E. tremula does not cause toxicity at the doses studied. A detailed experimental analysis of its chronic toxicity is essential for further support. Further work on the sub and chronic test of the plant should be conducted.

ST2-1-004S: A Review of Aflatoxins

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Contamination in the Cereals, Pulses and Nuts Value Chains and Household Food Insecurity and Safety In Kenya

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Background: Aflatoxins contamination in the cereals, pulses and nuts value chains is a cause of food insecurity and safety. People living in the semi-arid areas are vulnerable to food contaminated with aflatoxins. The effect of aflatoxins is acute symptoms of severe illness appearing very quickly. Longer term chronic and cumulative effects on health, including induction of cancer and immune deficiency are associated with aflatoxin consumption. Good agricultural practices are among the preventive measures to contain aflatoxin contamination. Objective: To review the levels of aflatoxins contamination in the cereals, pulses and nuts value chains

Methods: About 55 reference materials were searched using the key words aflatoxins, good agricultural practices and the key findings are presented.

Results: High risk commodities include maize, rice, nuts and pulses. In 2009 the Ministry of Agriculture condemned 155,900 90kg bags of maize contaminated with aflatoxins. In 2003, 68 people died of aflatoxin poisoning in the former eastern province. In 2005, 32 out of 75 of the reported cases of aflatoxin poisoning in former eastern province were fatal. In 2006, 28 out of 71 cases reported in makueni and machakos, were fatal. In 2014 seven people died of aflatoxin contamination in Loitoktok Kajiando County. A cross sectional study was conducted in Machakos County in 2017 on 64 random samples derived from four sub counties and taken from households, traders and institutions and tested for aflatoxins. The acceptable levels of aflatoxins in Kenya and the East African region is 10 PPB and below. Out of the 64 samples tested those with ≥ 10 PPB were 0, 11-20 PPB were 0 while those between 21 to ≥ 50 PPB were 55. Those between 51 PPB and ≤ 100 were 8 samples while one sample had ≥ 100 PPB.

Conclusion: This results necessitate a plan of action.

Key words: Aflatoxins, cereals, pulses and nuts, Good agricultural and post-harvest management practices

ST2-1-005S: Effect of cooking temperature and cleaning methods on the levels of mancozeb and ethylenethiourea in tomato

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Background: Vegetables are a major source of essential nutrients such as minerals, proteins, energy and also a source of roughage. These vegetables are affected by pests and diseases that are controlled using pesticides among which are fungicides such as dithiocarbamates (DTCs) which are toxic to human and animals at high concentrations and also injurious to the environment. Cooking degrades DTCs to metabolites such as ethylenethiourea (ETU) while proper cleaning can remove the residue considerably. Mancozeb a DTC is commonly used in Kenya and one of the metabolite ETU has a long residual time of between five to ten weeks and is believed to be carcinogenic. Objectives: This study determined the effect of temperatures and cleaning methods on the residue levels of mancozeb and the metabolite ETU on tomato (Lycopersicon esculentum). Methodology: The tomatoes were picked from an experimental garden one day after spraying with mancozeb in separate 1kg sample portions. Some samples were analyzed without treatment, others were subjected to heating at various heating temperatures and the third category of samples was subjected to cleaning with selected solvents before extraction and analysis. The analyte were extracted using acetonitrile-dichloromethane-chloroform and analyzed using HPLC gradient elution. Results: The temperature treatment showed a significant increase of ETU residues from a mean of 9.43±0.03 mg/kg at 25 °C to a mean of 12.43±0.38mg/kg at 90°C, while mancozeb levels decreased from 5.23±0.02 mg/kg at 25 °C to non detectable levels at 60°C. The levels of ETU in tomato reduced from 46±0.71m/kg to 0.05±0.00 mg/kg when cleaned with sodium hypochlorite while cleaning with water alone reduced ETU to 0.27±0.08 mg/kg. Mancozeb levels in tomato cleaned with sodium hypochlorite, reduced by 95.2% while cleaning with water removed 16.2%. Cleaning with sodium hypochlorite showed a significant removal of fungicides compared to cleaning with water only. Conclusions: The results from this study indicates exposure of mancozeb and ETU in fresh and cooked tomato, hence a need for cleaning with chlorine and rinsing with water before cooking or consumption and a need for more alternatives of chemical cleaning with inclusion of a regular surveillance of the fungicides and the metabolite ETU.

Key words: Mancozeb, Ethylenethiourea, Cooking, Temperature, Residue, Tomato, Cleaning
ST2-1-006S: Food Safety Issues Associated with Pastoralist Milk in Northern Kenya

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Background: Despite milk being an important component of pastoralist food security, the milk value chain is faced by several food safety issues: Objective: This study assessed the food safety issues along the pastoralist milk value chain in Northern Kenya. Data was collected through household interviews (n=260), focus group discussions (n=14), key informant interviews (n=14) and milk quality analysis (foreign particles, total viable counts (TVC), coliforms and antibiotic residues). The data were analysed using descriptive statistics. Results and Discussion: About 72.3% of the households reported screening their livestock for mastitis before milking. The main mastitis screening methods were pouring on black surface and checking for clotting (36.4%), observing physical swelling of the mammary gland of the animal (26.3%), milking on the ground and checking for blood spots and clotting (34.3%). These methods, can only detect clinical mastitis. About 10% of the households consumed the mastitis milk – either raw or in tea. The main types of containers used to handle milk were traditional milk containers (80%) and plastic containers, i.e. recycled cooking oil containers (20%). Plastic containers are difficult to clean and present food safety concerns. Milk consumed in the household was of varied safety standards. Hair/fur, sand, soil, charcoal flakes were present in 97.9% of the samples (n=47). Antibiotic residues were detected in all the samples, an indication of non-observance of withdrawal periods after administration of drugs to livestock. A third of all the analysed milk samples had TVC and coliform counts above the Kenya Standards for Grade I raw milk, i.e. TVC ≤2 x10⁵ cfu/ml; coliforms ≤1.0 x 10⁵ cfu/ml. Consumption of raw milk was high among the pastoralist population: Conclusion and Recommendations: These food safety issues could be addressed through capacity building on better mastitis detection methods such as the California Mastitis Test for detecting both clinical and sub-clinical mastitis pathogens; capacity building on dangers of consumption of raw milk, and on hygienic milk handling, focusing on all actors in the milk value chain.

Key words: Milk, food safety, pastoralist, Kenya

ST2-1-007S: Good practices on dealing with mycotoxin contamination: Survey results from GIZ projects on mycotoxin infestation

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Background
Aflatoxin turns nutritious food into a food safety hazard. It is a type of mycotoxin produced by a specific species of fungus, which can be very toxic and a potent carcinogen. It has been directly correlated to adverse health effects, such as liver cancer. Aflatoxins are largely associated with major agricultural crops such as maize, rice, peanuts and groundnuts.

Objective: Survey conducted to capture good practices on dealing with mycotoxin contamination in GIZ projects. Methodology: Online survey among GIZ projects; nine projects responded to the survey (2x Malawi, Zambia, Ghana, Burkina Faso, Togo, 2x Benin, Cambodia) Results: Projects in Malawi (2x) and Zambia as well as Ghana, Burkina Faso and Togo address mycotoxin contamination, mainly aflatoxins, working with and along the value chains; reasons are mostly trade barriers and agricultural productivity and to a lesser extent health risks and national economy. In some countries there is little awareness and no regulation; in others there are strategies planned and Burkina Faso, Malawi and Ghana even carry out awareness trainings. Standards for mycotoxins mainly exist for aflatoxins and thresholds are mostly set for export. If thresholds exist for domestic trade, then the limits are set higher than those for export. Five projects conduct awareness trainings on crop management, harvesting and post-harvesting for different target groups such as farmers, traders and women. Projects apply different approaches to prevent mycotoxin contamination along the value chains during pre-harvest (application of Aflasafe, good/best agricultural practices, irrigation, minimum tillage), harvest (timing, careful handling, tarpaulin, nut in shell), post-harvest (solar dryer, control of humidity, dry storage) and processing (sorting of damaged and mouldy seeds).

Conclusions: Pertinence of topic, more engagement needed. Nutritional impact of mycotoxins: reduction of available food quantities, degradation of quality, risk to vulnerable population. No gold standard, but certain practices can reduce the infestation rates substantially. More engagement in several aspects needed: focus at small scale farmer (also policies), standards/ control/ threshold values; food diversification strategies.
ST2-1-008S: Are banned pesticides still in use? The case of neonicotinoids
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Adequate food means more than simply caloric quantity. It means sufficient nutritious food – free from unsafe substances. This paper highlights some of these concerns and create awareness towards the role of citizens in holding authorities accountable, as well as safe food practices and consumer choices. Recently, concerns have been raised about the safety of food in Kenya along the entire food value chain – from production practices, to transport, handling, storing and preparation. Farming in the country depends heavily on chemical inputs (pesticides, herbicides, fungicides and fertilizers). As a result, chemical residue levels have been found by recent studies to be above the maximum residue levels acceptable for human consumption and found in locally available processed and unprocessed food products. Despite concerns raised by the public, pesticides such as neonicotinoids are still heavily and widely used in Kenya. Imidacloprid and thiamethoxam, for example, are approved for use in controlling insect pests in coffee farms, french beans, maize, cotton, wheat, forestry nurseries, roses, tobacco and vegetables. Currently, there are 41 different products in the market which contain these two active ingredients among them Thunder and Confidor, marketed by Bayer AG, and Cruiser and Actara marketed by Syngenta Ltd. The Pests Control Products Board (PCPB) has registered 718 products of which 28% are not approved in Europe because of their potential human or environmental health effects. With emerging scientific findings suggesting that neonicotinoids pose a health risk to the human nervous system coupled with its contamination of waterways and food, there is an urgent need for policies and the institutional infrastructure to monitor and ensure food safety and nutritional quality standards are achieved and maintained for producers and consumers.
ST2-3-001S: Food Safety Related Knowledge, Attitude and Practices among Food Marketers and Traders in Nairobi City’s Informal Settlements, Kenya

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Background: Urbanization, increasing population pressures and lifestyle changes continue to affect food access. Informal settlements are characterized by over population, low incomes and undeveloped infrastructure. Most residents lack post-secondary education. Nutrition education interventions have shown a positive relationship between knowledge and practices. However, this may not be the situation in food safety practices especially when knowledge alone is not adequate for correct food safety practices.

Objective: To establish the food safety related knowledge, attitude and practices among food marketers and traders in Nairobi City’s informal settlements, Kenya.

Methods: A cross-sectional survey design was adopted among 204 randomly selected respondent food marketers/traders selected from three randomly sampled informal settlements (Kibera, Githurai and Kayole estates) in Nairobi city. A structured questionnaire was used to collect data. Descriptive and inferential statistics were used at significance of p<0.05. Written informed consent was sought from the respondents and confidentiality assured.

Results: 67.2% of the respondent marketers/traders were females with a mean age of 34.8±1.29 years. About 68.6% of them were married while 30.4% and 54.4% had only primary and secondary education respectively. Nearly all of them, 87.7%, 88.7% and 97.5% owned radio, TV and mobile phones respectively. Only 12.7% had received training/knowledge on food safety in the last 6 months mainly from a health worker. About half of them 46.6% had never heard of aflatoxin and related effects with 31.4% knowing the main cause of aflatoxin in cereals was excess moisture and incomplete drying and 42.2% knowing that cereals infested by aflatoxin moulds were unfit for human consumption. Half of them (50.5%) knew at least ≥ 2 food practices that make food unsafe while 19.6%, 36.8%, 16.7%, 18.6% and 34.8% knew other traders who sell artificially ripened fruits, sell vegetables grown from sewage water, sells vegetables with chemical residue, mixes bad/rotten and good cereals and legumes to reduce cost and adds chemicals to milk to make it last longer, taste and appear good respectively. 36.3% were bothered that they could be selling unsafe and spoilt food to their customers. Only 54.4% had access to food storage facilities, most of which was hired. Nearly all of them, 96.1% and 98.0% had reliable water access and functional toilet facilities at the market place respectively.

Conclusion and recommendation: There was evident need for training in food safety. Marketing food safety information and correct messaging, among suppliers, middle-men and marketers/traders and improved infrastructure are recommended.

Key words: Urban, Food Safety, Knowledge, Practices

ST2-1-010S: Profiling of Antibiotic Resistant Bacteria and Antibiotic Residues in Raw Chicken Products Sold at Kenyatta University and its Environrs

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Background: Antibiotics constitute major xenobiotics present in human food and occur in products sourced from animals especially livestock. These antibiotics get into animals when taken orally as antibiotic amended animal feed and water, or through direct injection. Ingestion of animal food contaminated with antibiotics leads to chronic exposure of gut microflora and clinically relevant bacteria to low levels of antibiotics. Such exposure may lead to antibiotic resistance and other health issues.

Objective: This study aimed at determining the presence of antibiotic residues in raw chicken meat sold in Kenyatta University (KU) and the bordering Kenyatta Market (KM), isolating bacteria pathogens and profiling antibiotic resistance of the pathogens.

Methods: A total of eight meat samples and eight egg samples were randomly collected from each study site in sterile zipped containers and transported to the laboratory for analysis. Selective
and differential media were used to isolate pathogenic bacteria from raw chicken meat and eggs. Disc diffusion technique was used to test the resistance of isolated bacterial strains to commonly used antibiotics. The disc diffusion technique was also used to detect the presence of antibiotic residues in raw chicken meat and eggs, using four test organisms namely *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, and *Salmonella typhi*. Viable bacteria counts were done by spread plate method and recorded as colony forming units (CFUs) while selective and differential media were used to isolate pathogenic bacteria from the raw chicken and eggs. Resistance to commonly used antibiotics was tested on these isolated bacteria strains.

**Results:** From the chicken products sampled, an average of 87.50% and 100% meat and egg albumen respectively exhibited the presence of antibiotic residues. The mean CFU of meat samples from KM (190.25 x 10²±15.367) was significantly more than that of KU (104.96 x 10²±6.767). Eggs from KM were also more contaminated than those sampled within the university outlets with means of 158.88 x 10²±14.299 and 108.29 x 10²±8.735 respectively. *E. coli*, *Salmonella sp*, *Shigella sp* and *Proteus* were isolated from both sites. All these four pathogens isolated were found to be resistant to ampicillin, moderately susceptible to tetracycline and amikacin, and susceptible to ciprofloxacin, chloramphenicol, and gentamicin. From the sampled chicken meat and eggs, an average of 87.50% and 100% exhibited the presence of antibiotic residues respectively. All (100%) farmers practised animal production. The main sources of irrigation water were: rivers (68.2%), wastewater (4.5%), borehole (11.4%) and rainfed (17.8%). All samples did not meet chemical quality whereas 53.3% conformed to microbial quality for irrigation water (NEMA, 2006). The main household food source was own production (51%). Majority had Household Dietary Diversity Scores (HDDS) ≥4 (98.5%). HDDS for those farming on own compounds were higher (7.1±1.2) than those farming on river banks (6.5±1.7). According to HFIAS, majority of households were food secure (75.6%) whereas 7.0%, 11.4% and 6.0 % were mildly, moderate and severely food insecure respectively.

**Conclusion:** UPA has potential for contributing to food security among urban populations. Compliance to government legislations on wastewater re-use should be ensured for safe foods.

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**ST2-2-001S: Potential For Wastewater Re-Use In Urban And Peri-Urban Agriculture To Mitigate Household Food Insecurity In Nairobi, Kenya**

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**Background:** Global trends indicate rapid urbanization among cities in developing countries. Consequently, poverty, food insecurity and malnutrition levels have been increasing among urban populations. Urban and Peri-urban Agriculture (UPA) is increasingly gaining recognition because of its critical role in shaping food security. In Kenya, wastewater re-use has been utilized in household food production due to scarcity of water resources. Despite its potential to contribute to UPA, food safety concerns arise from its utilization. There is need for scientific evidence on the role of wastewater re-use in enhancing agricultural production. **Objective:** To establish the potential of wastewater re-use for UPA in mitigating the household food insecurity among urban and peri-urban (UP) areas in Nairobi County. **Methodology:** Using a cross-sectional study design, a household survey was conducted in UP areas of Nairobi County; Juja, Ruiru, Ruai, Githurai, Athi river and Waithaka metropolitan areas. A total of 300 farmers were randomly selected using lists from Ministry of Agriculture. Land ownership, wastewater re-use and UPA practices. **Results:** Land ownership varied; owned (21.5%), rented (40.7%) and road reserves (19.6%). All (100%) farmers practiced crop production with 64% farmers practicing animal production. The main sources of irrigation water were: rivers (68.2%), wastewater (4.5%), borehole (11.4%) and rainfed (17.8%). All samples did not meet chemical quality whereas 53.3% conformed to microbial quality for irrigation water (NEMA, 2006). The main household food source was own production (51%). Majority had Household Dietary Diversity Scores (HDDS) ≥4 (98.5%). HDDS for those farming on own compounds were higher (7.1±1.2) than those farming on river banks (6.5±1.7). According to HFIAS, majority of households were food secure (75.6%) whereas 7.0%, 11.4% and 6.0 % were mildly, moderate and severely food insecure respectively. **Conclusion:** UPA has potential for contributing to food security among urban populations. Compliance to government legislations on wastewater re-use should be ensured for safe foods.
Consumption of tomato sauces has become a norm in our society because many people young and old have turned into eating processed foods that are served together with tomato sauces. Sodium benzoate is added to tomato sauces as a preservative. It inhibits the microbial activity in foods in very low concentrations. It has become a health concern because it destroys mitochondrial DNA. It is also responsible for attention deficiency hyperactivity disorder and in presence of vitamin C, it forms benzene that is carcinogenic. This study was undertaken to access the level of sodium benzoate in various brands of tomato sauces in supermarkets in Nairobi County. A total of 30 samples representing 8 brands of tomato sauces were purchased from selected supermarkets in Nairobi city centre. Samples were processed and analyzed for sodium benzoate using high pressure liquid chromatography (HPLC). The data was then analyzed by analysis of variance (ANOVA). The levels of sodium benzoate obtained ranged between 915.0 ± 53.0 to 3100.0 ± 17.7 mg/kg. Twenty nine (29) out of 30 (97%) samples analyzed had levels of the analyte above the maximum allowed level of 1000 mg/kg. This study therefore recommends a sensitization of the public on the use of tomato sauces.

**Key words:** Sodium benzoate, HPLC, Tomato sauces.

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**ST2-3-004S: Keeping Quality of Complementary Food Based on Steeped, Germinated and Extruded Amaranth and Sorghum Grains.**

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Food safety in the entire food chain is key in ensuring consumer’s health protection. Diarrheal disease account for 1 in 9 deaths in children below 5 years of age globally while in Kenya is 6.8%. Contaminated food is the major cause of diarrhea and remains a health issue worldwide despite the effort of governments to improve safety of food supply. Children under age of 5 years are among the groups that are susceptible to foodborne illness. This is due to their developing immune system, unique exposure pathways and their need for more food per their body weight. Diarrheal disease is reported to increase after introduction of complementary foods. A complementary food based on steeped and germinated 90% amaranth and 10% sorghum grain was formulated with the aim of meeting the nutrition need of children in Kenya. It was tested and found to be superior nutritionally to the commonly used complementary foods. Its safety is important. The objective of this study was to determine its keeping quality for shelf life stability and safety. Water activity is a key indicator of stability and safety of dried foods with respect to spoilage and a critical control point for many manufactures. Moisture sorption isotherm of the product was determined at 25°C, 30°C and 35°C using gravimetric method and Guggenheim, Anderson and de Boer (GAB) model was used to establish its safe storage moisture content. Product's microbial stability was also assessed through total plate count and yeast and molds using spread plate method for six months storage at 35°C and 75% RH. GAB model gave 7.5% (0.6 water activity) as the product's safe moisture content below which no microbial growth can be supported. The product had nil yeast and molds and log 3.8cfu/g aerobic microbial count which is within acceptable limit. There was no microbial growth in the entire storage period which may be attributed to low water activity in the samples. The product storage moisture content should be maintained below 7.5% to ensure safety. Kraft paper with polyethylene laminate is recommended for packaging due to its barrier properties, physical strength, sealability and economic viability.

**Key words:** Quality, Amaranth, Sorghum, Complementary food
concentration at high trophic levels. They also tend to alter the normal functioning of the endocrine system due to their endocrine disrupting activity. Since 1998, the fisheries sector in Lake Victoria has had an abusive history following the ban of fish export to European Union as a result of using chemical pesticides such as endosulfan for fishing. There are also unjustified claims that in order to extent the shelf life of products in the markets some unfaithful fish sellers store their fish products using chemicals such as pesticides and other unknown repellants which might be potential sources of PCBs in fish products along the food chain from fishing to consumption. It is also suspected that some processors use transformer oils for fish frying and consumption of smoked fish products is common in the area. Both transformer oil and smoke are good sources of PCBs in the environment and food items. A study was therefore conducted in Lake Victoria with the objectives of assessing the levels and risks of indicator PCBs in four processed *L. niloticus* fish products (salted and sundried, trims, smoked and deep fried). Fish samples were collected from randomly selected fish sellers in the markets and extractions were done using a Quick, Easy, Cheap, Effective, Rugged and Safe (QuEChERS) method while detection and quantification of congeners was done using a Gas Chromatograph equipped with Electron Capture Detectors and Mass Spectrometry (GC- ECD/ MS). Data were analyzed using SPSS, Version 16.0. Data on PCB concentration were presented as mean ± SD. One – way ANOVA was used to compare concentrations between products. In data processing, the concentrations of PCBs in samples below the limit of detection (<LOD) were treated as zero. Separation of means was done using Duncan’s Multiple Range Test. Significance was declared different at p<0.05 for all analyses. Human health risk assessment was done using existing models provided by the United States Environmental Protection Agency (USEPA) and Agency for Toxic substances Disease Registry (ATSDR). Six indicator PCB congeners (CB 28, CB 52, CB 118, CB 138, CB 153 and CB 180) were detected at measurable quantities in different fish products whereas CB 101 was not detected (ND) in any of the four fish products. The total PCBs loading were 28.46±9.35 μg/kg (salted and sundried products), 31.55±16.66 μg/kg (trims), 30.67±6.23 μg/kg (smoked products) and 16.05±3.04 μg/kg for deep fried products. PCBs loading were dominated by CB 138, CB 153 followed by CB 180 due to structures and high degree of chlorination. These congeners are highly chlorinated compared to others; studies indicate that increase in number of chlorine substitution increases the half-lives of the compounds and thus can easily be found in environmental samples and food items. However, the mean concentration of PCBs in this study were below MRL of 75 μg/kg set for fish by European Commission, implying that the fish products are safe for human consumption in regard to indicator PCBs. For both adults and children the cancer risks were low to moderate (between 1.7E-04 and 3.3E-04 for adults and 1.6E-04 and 7.8E-04 for children) while the non-cancer risks were insignificant as the HI were less than one. This indicates that the levels of PCBs in fish products from Lake Victoria are not a health risk and that the fish products are safe for human consumption in regards to indicator PCBs. The research findings obtained in this study will help decision makers to devise appropriate measures for risk mitigation for safeguarding consumer’s health.

**Key words:** PCBs, Salted and sundried fish, Trims, smoked fish, deep fried fish, Cancer risks, Non-cancer risks

**ST2-5-002S: Health risk assessment on selected essential and non-essential elements in food crops grown in Kibra slum, Nairobi-Kenya**

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Peri-urban agriculture of food crops is practiced in many slum areas of cities in developing countries, often involving the use of waste water and soils. Kibra slum, a densely populated slum in Nairobi, practices peri-urban agriculture, growing kales, amaranthus, arrowroots, and spinach food crops. The study determined the levels of selected essential and non-essential elements and then assessed health risks associated with the consumption of the food crops grown. A randomized block design was used during sampling. Chemical analysis was performed using atomic absorption spectroscopy (AAS) and health risk assessment was done using daily intake of metals (DIM), target hazard quotient (THQ) and incremental lifetime cancer risk (ILCR). ANOVA was used to measure differences in levels in gardens. The levels of essential elements; Mn, 91.04-374.44, Mg, 261.28-532.96, Fe, 350.74-1273.68, and Zn 1.18-6.3 μg/g were below the recommended limits by FAO/WHO, implying no health risk. Ranges of the non-essential elements; Cr 1.15-4.32 and Pb 0.14-0.91 μg/g were above the EU recommendation, implying a health risk. DIM of Fe, 5.81-27.61 and Mn, 1.97-8.12 μg/g were above the recommended daily intake amounts, implying a health risk. THQ values for Mn and Fe were more than unit (THQ > 1), also implying a potential health risk. THQ values for non-essential elements were below unity (THQ < 1) except for Pb in arrowroots in garden U002 (THQ > 1). ILCR showed that from lead alone 73 people are likely to develop cancer this translates to 0.043% of 0.17M residents. THQ results suggest that consumption of arrowroots, amaranthus, kales, and spinach grown in Kibra slum poses a likely Mn and Fe health risk to the local inhabitants.
ST2-5-003S: Prevalence and Characterization of Aspergillus flavus And Other Moulds in Fresh and Dried Fish Sold in Kisii County, Kenya

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Background: Consumption of fish provides a balance of protein, vitamins and minerals. However, fish is sometimes contaminated with fungi that produce aflatoxins. Consumption of aflatoxin contaminated fish can cause serious negative health implications such as cancer. Objective: This study aimed at determining the moulds associated with fresh and dried fish sold in Kisii County. Methodology: Samples of fresh and dried catfish, Nile perch, Rastrineobola argentea and Tilapia were obtained from four markets by systematic random sampling. Moisture content of all samples was determined by oven drying. The prevalence and characterization of Aspergillus flavus and other moulds was determined through morphological techniques using Sabouraud Dextrose Agar, Czapak Dox Agar and Aspergillus flavus and parasiticus agar. Result: Seventeen fungal species namely; Cunninghamamella, Rhizopus, Penicillium, Candida, Phoma, Trichoderma, Aspergillus, Mucor, Alternaria, Fusarium, Trichophyton, Cladosporium, Acremonium, Mycosporum, Geotricum, Scopulariopsis and Cladophialophora were isolated from both fresh and dried fish. Aspergillus spp was frequently isolated from fresh Rastrineobola argentea (6.3%) from Riosiri, tilapia (13.5%) from Keroka, Nile perch (11.5%) and catfish (11.5%) from Riosiri. For dried fish, Aspergillus flavus was frequently isolated from Rastrineobola argentea (26.5%) and tilapia (18.3%) from Nyakoe, Nile perch (19.2%) and catfish (28.6%) from Daraja Mbili. All the samples of dried fish had moisture content above the recommended 10%. Dried Tilapia had the highest moisture content (38%). Conclusion: These results indicate that fish sold in Kisii county is contaminated with Aspergillus flavus and other moulds which could pose a health risk to consumers.

ST2-5-004S: Are our vegetables on Drugs? Sulfamethoxazole Residues in Vegetables Irrigated with Untreated Wastewater:

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Untreated wastewater is used for growing of vegetables in small scale urban farming. Vegetables grown or irrigated with untreated wastewater may contain high levels of antibiotic drug residues that are detrimental to health. Sulfamethoxazole(SMX) drug is an antibiotic, administered in the management of pneumocystis carinii pneumonia, pneumocystis jirovecipneumonia, toxoplasmosis and genitourinary tract infections in HIV-AIDS patients or in cases of oral thrush infections. It is cheap and readily available over the counter even through self-prescription for management of upper respiratory tract and genitourinary tract infections. The drug is also administered to poultry and livestock as a growth promoter, prophylactic and to control microbial infections. Its presence in vegetables could induce microbial resistance and minimize drug sensitivity. The concentration of sulfamethoxazole in untreated wastewater and vegetables collected during the dry season from various sites in Ruai and Njiru from small scale urban farms along Ngong River was determined. The samples for sulfamethoxazole residues underwent solvent extraction pre-analysis and the extracts were then analyzed using high performance liquid chromatography. The untreated waste water and vegetables were found to have sulfamethoxazole drug residues. This implies that some of the vegetables in the market have drug residues which can compromise the heath of the people taking them, but more so development of drug resistant strains. It is also important to determine drug residues in all matrices especially water and foods for humans and to sensitize the public on the same. Keywords: Untreated wastewater, Sulfamethoxazole, Vegetables; Human Health
ST2-5-005S: Zoonotic Non-tuberculous Mycobacteria isolated in dromedary camel milk and sputum of associated household members in Samburu East, Kenya.

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Office International des Epizooties (OIE) criteria.

Keywords: zoonotic, Nontuberculous Mycobacteria, dromedary camel, camel milk, human sputum, risk factors, Samburu, Kenya

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Background: Nontuberculous Mycobacteria (NTM) are recognized as important human pathogens, in addition, they confound diagnosis and therapy of tuberculosis due to Mycobacterium tuberculosis (MTB). NTM infection may occur through ingestion, inhalation or dermal contact. Among the species of zoonotic importance from camelds are M. chelonae, M. fortuitum, M. marinum, M. scrofulaceum, M. xenopi, M. simiae, M. szulgai, M. kansasi, M. leprae and M. avium. The aim of this study was to identify the Mycobactera from camel milk and sputum of associated household members and assess risk factors for infection in Samburu East, Kenya. Methodology: A 30-40ml composite milk sample was collected in sterile 50ml falcon tubes from all camels classified as tuberculin skin test positive or inconclusive according to Office International des Epizooties (OIE) criteria. Sputum was obtained from members of participating households with TB case definition for tuberculosis. All samples were submitted to KEMRI/CRDR for mycobacteriology, confirmatory culture, speciation and strain typing using HAIN® line probe assay. A standard questionnaire was administered to participating households. Results: A total number of 226 camel milk samples were collected, 36/226 (15.9%) showed the presence of acid fast bacilli (AFB) on culture after 8 weeks. Of the human sputum samples, 3/48 (6.25%) showed presence of AFB on culture after 8 weeks. The species identified using HAIN® CM assay from milk culture isolates were M. fortuitum (1), M. szulgai (19), and 17 unknown Mycobacteria species. Mycobacterium fortuitum (1), M. szulgai (1) and one unknown Mycobacteria species were identified from sputum. Turkana breed of camel (OR=3.4; 95% CI: 1.2 – 9.3), source of new introductions; Outside the county (OR=2.1; 95% CI: 0.3-12.3) and; No introductions (OR=3.2; 95% CI: 0.7 – 14.7) were found to be strongly associated with camel milk culture positivity. Conclusion: Preliminary data shows that NTM exist in both camel milk and sputum of household members suggesting cross transmission due to habitual consumption of raw unpasteurized camel milk among Samburu community.

Keywords: zoonotic, Nontuberculous Mycobacteria, dromedary camel, camel milk, human sputum, risk factors, Samburu, Kenya

ST2-5-006S: Isolation Of Listeria Species In Milk And Meat Products In Nairobi And Its Environments And The Implication In Food Safety

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Background: Listeriosis, caused by Listeria monocytogenes, is among the most important foodborne diseases worldwide. The disease is said to be the leading cause of death in reported cases of food poisoning with mortality rates of between 30%-50%. Objective: The aim of the study was to determine the occurrence of Listeria species, specifically Listeria monocytogenes in milk and meat products sold in retail markets in the study area. Methodology: The study was conducted in the Nairobi Metropolitan region where 350 milk and 220 meat products were collected from selected retail markets. Isolation and identification was done as per the FDA/BAM method. DNA from identified colonies was extracted and multiplex PCR done to identify the genus and species of Listeria. Results: Out of the 570 samples, 8.59% tested positive for Listeria species. Twenty one (42.8%) isolates were from milk products namely; milk powder (5.8%), short life milk (1.5%), long life milk (4.83%) and milk from dispensing machines (80%). The rest, (57.2%) were obtained from meat products namely; ham (5.4%), brawn (17.8%), polony (29.6%), salami (16.7%) and ready to eat meat (5.19%). Speciation of the isolates confirmed 22 as L. monocytogenes (3.86%), a majority of which (77.27%) were from milk products while the rest (22.72%) were from meat products. The highest prevalence, 68.18 %, was from dispensed milk while the lowest, 4.54%, was from short life milk, long life milk and ham. Of the other 27 Listeria isolates, two were identified as L. welshimeri while three were identified as L. innocua. The rest were unidentified Listeria. Conclusion: These results have far reaching implications in food safety.
implications in terms of food safety to stakeholders in the food processing industry, human and animal health practitioners and the consumers of these products.

**Keywords:** Listeria, Ready to eat foods, *Listeria monocytogenes*

**ST2-5-007S: Heavy Metal Contamination Of Sugar And The Sugar Chain Products In Nairobi And The Environs, Kenya**

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**Background:** Heavy metal occurrence in foods is a public health concern as they associated with acute and chronic toxicities. The major heavy metals include lead (Pb), chromium (Cr), arsenic (As), zinc (Zn), cadmium (Cd), copper (Cu), mercury (Hg), and nickel (Ni). Heavy metal contamination can occur at primary production level (soils, polluted irrigation water, dumpsites, industrial water and e-wastes) as well as during food processing and packaging. Regular monitoring of food products is therefore recommended. This study was conducted nearly a year after media reports indicated the presence in the country of sugar imports suspected to be contaminated with heavy metals. **Objective:** To establish the levels of Pb, Cr, Zn, Cd, Cu, Fe and Ni in sugar and sugar chain products commonly sold in retail outlets in urban and peri-urban areas in Kiambu and Nairobi Counties. **Methodology:** In an experimental study, sugar and sugar chain products were randomly sampled from supermarkets and retail shops. A total of 44 samples including sugar (n=16), fruit drinks (n=13), jam (n=10) and cakes (n=5) were analyzed in triplicates. After wet digestion, the concentration of the different metals was determined using Atomic Absorption Spectrophotometry. **Results:** All the samples conformed to the Maximum Permissible Limits (MPL) for Iron, Cadmium, Copper and Lead. However, 34% of the samples (n=15) tested above the MPL for Nickel while 52% (n=23) of the samples exceeded the MPL for Chromium. Cadmium was not detected in any of the samples. Chromium levels ranged between 0.20 – 4.99 ppm while Nickel levels ranged between 0.04 – 1.20 ppm. Sugar and jam samples showed the highest levels of chromium and nickel exceeding MPLs of 0.5 ppm. **Conclusion:** High levels of Chromium and nickel were found among the analyzed samples posing health hazards to consumers. There is need to investigate the possible sources of heavy metal contamination in the sugar value chain. Frequent monitoring of products by regulatory bodies is also key to ensure consumer protection.

**Key words:** Heavy metals, contamination, sugar, maximum permissible levels

**ST2-6-001S: Electronic Nose as a Screening Tool for Detection of Aflatoxin Contamination of Maize.**

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**Background:** Among the mycotoxins, aflatoxins, produced by *Aspergillus flavus* and *Aspergillus parasiticus*, pose the greatest threat for agriculture, trade and human health in developing countries. Consumption of highly contaminated grains results in acute aflatoxicosis which can be fatal, while chronic aflatoxicosis as a result of long term low level exposure is more prevalent and is highly correlated with increased incidences of liver cancer, malnutrition, immunosuppression, and impaired growth in children. Management of aflatoxin remains problematic, particularly in developing countries where there is lack of well-established regulatory systems to frequently monitor food samples prior to trade or human consumption. The problem is further compounded by limited analytical capacity. Available screening and analytical techniques are fraught with numerous challenges, including high cost, laborious and time consuming procedures and lack of necessary infrastructure. The objective of this study was to evaluate the potential for electronic nose to detect aflatoxin contamination in maize. **Methodology:** The performances of three electronic nose instruments based on different sensor technologies were compared using an Australian maize variety artificially inoculated with *A. flavus*. The study documents higher discrimination capability between aflatoxin contaminated and uncontaminated maize with the metal oxide based sensors when compared to the conducting polymer sensors. Based on the marginally higher classification accuracies achieved, field portability and lower capital cost, the electronic nose equipped with metal oxide semiconductor sensors with cyclical thermal modulation (DiagNose) was selected for further evaluation, using Kenyan maize varieties artificially and naturally infected with *A. flavus*. **Results:** The DiagNose was able to discriminate between controls and maize samples artificially inoculated with *A. flavus* for two Kenyan
ST2-6-002S: Efficacy of mycotoxin binder on aflatoxin m1 and mazzican on total bacterial count in raw milk among smallholder dairy farmers in Kisumu County, Kenya

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Background: Worldwide, milk forms a major part of human diet especially for children and expectant mothers. However, milk in East Africa has been shown to be frequently contaminated with aflatoxin M1 (AFM1) and bacteria. The efficacy of NovaSil clay (NS), a mycotoxin binder, and Mazzican, a hygienic milk container, to reduce levels of aflatoxin M1 and total bacterial counts respectively were evaluated in raw milk samples collected from urban and peri urban areas of Kisumu, Kenya. Materials and methods: A baseline survey was conducted in 97 farms, and 72 raw milk samples were collected. Thirty farms identified as producing milk with AFM1 levels above 50 ppt, which is the recommended limit by EU, were randomized to either receive the intervention (including training, NS and Maziccan, n=20), or not receive intervention (control, n=10). NS was to be administered in 1-2 teaspoonful per 2 kg of concentrate feed while Maziccan was to be used during milking, milk storage and transportation to the market. Raw milk samples from trial participants were collected biweekly for three consecutive months. AFM1 metabolites were quantified by enzyme linked immunosorbent assay with detection limit of 2 ppt. Total bacterial counts were obtained from colony counts of raw milk cultures. Results: Upon baseline testing, aflatoxin M1 levels in raw milk ranged from 0.001-151 ppt with a mean 29.40 ppt. The mean total bacteria count was 1.6x10^7 ± 5.2x10^6 Cfu/ml. Cfu/ml ranged from 3.3x10^2 to 2.4x10^8 Cfu/ml. Trial results indicate that giving 2 teaspoon of NS binder per 2 kg caused a significant statistical difference in reduction of AFM1 levels in the sampled milk, p=0.013, whereas this was not found when giving half the dose. Use of mazzicans revealed a statistical significance difference in reduction of total bacterial counts in the milk samples p<0.001. The study has 100% compliance in use of mazzican while 98% in NS use. Conclusions: Intervention effectively reduced AFM1 and bacterial counts in milk. The farmers were willing to invest in the intervention, therefore the possibility to supply farmers with NS and mazzican should be further investigated.

Key words: mycotoxin binder, mazzican, raw milk, smallholder dairy farmer

ST2-6-004S: Evaluating the effects of training and addition of mycotoxin binders on aflatoxin M1 reduction in milk: A case study of Kasarani sub-county, Kenya

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Background: Aflatoxins are toxic substances produced by species of Aspergillus fungi. They are carcinogenic, and their exposure can lead to serious health effects. Food and feed can be contaminated with the toxins at any stage along the production value chain. Aflatoxin contamination along the dairy value chain contribute to negative impacts to both food security and livelihoods. Aflatoxin M1 (AFM1) can be found in milk from cows if fed on diets contaminated with aflatoxin B1 (AFB1). Studies have reported high levels of AFM1 in milk marketed in Kenya. Several pre- and post-harvest control strategies exist and can, in combination, be employed in aflatoxin mitigation efforts. Our study aimed at assessing the effects of farmer training and addition of mycotoxin binders in animal feeds on...
Materials and methods: An initial survey was undertaken in a peri-urban area of Nairobi to determine baseline characteristics. A total of 30 farms comprising 20 intervention and 10 controls were randomly selected to participate in the trial. Intervention farms received training on aflatoxin control and mycotoxin binders (Novasil®) to be added to feeds given to animals during the study period. Control farms received none of the intervention tools. Biweekly visits were done to each farm, for three months during which data was collected and milk sampling was done. Samples were analyzed for AFM1 using Enzyme-Linked Immunosorbent Assay (ELISA). Results and Discussion: The mean AFM1 level at baseline was 118.4 ppt. Overall mean AFM1 at the start, middle and at the end of the study was 86.8, 81.6 and 66.1 ppt. On average AFM1 levels dropped by 57.7 ppt for intervention and 11.2 ppt for the control.

Conclusion: Training farmers on aflatoxins control and addition of mycotoxin binders to animal feeds is feasible in smallholder systems, and can be promoted as an approach to on-farm mitigation of aflatoxins. There is need to raise more awareness on their use and invest more on marketing approaches that are acceptable and locally sustainable.

Key words: Aflatoxin M1, Milk, Value chain, Mycotoxin binder, Training

ST2-6-005S: How Genetic Modification Corporations Exist and Flourish Despite Producing Harmful Products

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Genetically modified (GM) foods are foods derived from organisms whose genetic material (DNA) has been modified in a way that does not occur naturally. The proponents claim that genetically modified crops improve yield, increased tolerance of herbicides among others benefits. However, genetic modification of food crops have been taken-over by big multinational corporations which have rebranded themselves as biotech companies, but they are essentially chemical and pharmaceutical companies. In the last few years, studies have shown that GMOs are extremely detrimental to human health. The French scientist Gilles-Eric Seralini showed that rats fed GM maize developed malignant tumors, severe liver and kidney damage, and, in 4 months. GMOs are also implicated in causing a number of ailments, including autism, allergies, asthma, sterility, digestive disorders, kidney diseases, heart diseases, cancer and more. In addition, commercialization of GMOs go hand-in-hand with industrial pesticides. Most pesticides have glyphosate as the active ingredient which is extremely toxic to life, even at low levels. In Kenya, these products are highly used in farming. Despite the ban on GMOs in Kenya, these bio-tech corporations continue to sell their seeds unabated. The aim of this theoretical paper is to explain how multi-national corporations that have commercialize GM have remained afloat and manage to even expand their markets not only in countries with weak food safety standards (mostly in Africa) and but also in developed countries such as US among others. The paper explores how these multinational corporations influence research against negative effects of GMO through scholarships of almost all GM studies and control of scientific journals. The paper also explores the influence GM corporations on policy and laws not only in Africa but also in developed countries due to their financial muscles as well their influence on the media. Lastly, the paper shall try expound on how these multinationals systematically aim at eliminating traditional seeds and replacing them with GM seeds and therefore farmers and by extension, everyone will be at the mercy of few GM corporations on food matters and hence a matter of not only national health and also national security.

ST2-6-006S: Is the Immuno-chemical detection of peanut proteins affected by processing treatments?

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Background: Peanut proteins are a main cause of allergic reactions in foods. Doses as low as 100mg have been reported to trigger allergic response culminating to anaphylaxis and death. Declaration of allergens is a labelling requirement in food products and therefore detection is important. Processing treatments can affect the occurrence of allergenic proteins in foods consequently rendering them undetectable by antibodies used in the ELISA assays. There is limited scientific evidence on the effect of physico-chemical treatments on the detection of peanut proteins. Objective: This study was conducted to establish the effect of temperature and acid/alkali treatments on detection of peanut proteins. Methods: Purified peanut solution (10μg/ml) was prepared in Phosphate Buffered Salt Solution (PBS) (pH 7.4),
0.1M lactic acid (pH 4) and 0.1M Na₂HPO₄·2H₂O (pH 10). Duplicate samples were heated (100°C) and removed at intervals of 1 hour (PBS) and 5 minutes for acid/alkali treatments respectively and then cooled immediately. An indirect competitive ELISA was used to optimize on concentration of coating antigen, primary and secondary antibody. A competitive assay in the detection range of 1μg/ml was obtained. Absorbance was read at 450nm using ELISA reader (Titertek Multiskan plus; MK II). Competitive curves were obtained in duplicates and samples determined in quadruplets. Competition curves were fitted to a four parameter logistic function (Englebienne, 2000) and normalised by expressing experimental absorbance levels (B) as (B/Bo, max), B Bo, max where there is the maximal absorbance in absence of analyte.

Results: A similar trend for the three treatments was observed with a decrease in protein concentration to a constant level followed by gradual increase in concentration. The changes were more drastic under pH 10 compared to pH 4 and pH 7.4. The binding ability of the chicken Immunoglobulins (IgYs) which correlates with the detected levels to peanut proteins was altered by denaturation and hydrolysis of the proteins by treatments with a potential of unmasking new antibody binding sites. However, stable fractions persisted. Conclusions: Although immunoassays are specific, sensitive and rapid method to detect and quantify even trace amounts of food allergens, processing can alter proteins so that they are no longer detectable posing a risk of false negatives.

Key words: Peanut, Proteins, Heat, pH, Detection, Allergens, IgYs

ST2-7-001S: Assessing Food Handlers’ Hygiene Practices as Determinants of Customer Choice of Selected African Indigenous Restaurants in Nairobi City County, Kenya

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Dining is a common phenomenon in major cities since people have limited time due to work and related engagements. Indigenous restaurants have become a preference for most consumers attributed to factors such as health, curiosity and variety. Although hygiene is an important aspect in choosing where to dine, most customers are not keen observers. This study explored food handlers’ hygiene practices as determinants of customers’ choice of selected African indigenous restaurants’ in Nairobi City County, Kenya. A cross-sectional descriptive survey targeting 15 restaurants was done, and purposive sampling for the supervisors, proportionate sampling for food handlers and convenient sampling for the customers considered. Sample sizes of fifteen supervisors (15), 340 food handlers and, 384 customers were obtained. Two questionnaires, an interview guide and an observation checklist were used for data collection. Qualitative data was coded and summarized in compilation sheets for easier statistical analysis. Quantitative data was analyzed using SPSS Version 21 with confidence and significance levels established using paired tests with a cut-off point of P < 0.05, (95%). Chi square Pearson’s correlation coefficient tests were calculated to identify the correlation between food handlers’ hygiene practices and customers’ choice of restaurants. The findings presented a c² = 4.244, df* = 2 and p = 0.133 which is > 0.05. With a significance level > 0.05 (0.133), the alternative hypothesis (H1) was rejected. The findings showed that there was no significant relationship between the two variables. Most customers were not keen on hygiene standards as evidenced in some restaurants where regardless of the poor hygiene practices observed, they had high customer inflows. The study concluded that even though hygiene practices affected customers’ choice of the restaurants, it was insignificant. The study recommended the public health authorities to educate restaurant stakeholders and consumers on hygiene regulations and similar studies to be carried in more restaurants in rural setting.

Keywords: Food Handlers’, Hygiene Practices, Customer Choice, African Indigenous Restaurant

ST2-7-002S: Food Hygiene Knowledge and Practices among Minimally Processed Fruits Street Vendors in Central Ward, Nairobi County

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Background Minimally processed fruits (MPF) vended as street foods, despite numerous benefits, can cause food-borne illnesses due to poor hygiene practices and unsanitary conditions. Despite the economic benefits of this sector, it has also been recognized as a potential hazard to public health especially when food handlers do not practice proper hygiene when preparing the fruits, or when there is contamination. Objectives: This study sought to assess food hygiene knowledge and practices in minimally processed fruit vending businesses in Nairobi Central Ward. Methodology: This study adopted a cross sectional
analytical study design involving 323 conveniently sampled street food vendors (FVs). Data was collected using an observational checklist and structured questionnaire. The data was analyzed and summarized using descriptive statistics and presented in graphs and tabular form. SPSS version 21 and Kruskal Wallis test was used to assess the difference in hygiene knowledge and practice between the clusters, and established variable relationships at 95% confidence interval. Food Hygiene Knowledge (FHK) and Food Hygiene Practice (FHP) levels were ranked according to Bloom cut off points on calculated percentage scores. Results: Most vendors (62.8%) had low FHK and poor FHP (98.7%). There was no significant association between FHP and FHK (p-value=.916). Majority (76.6%) had knowledge on preparation of fruits and ensured general standards of hygiene (86.1%). Food safety sources of knowledge and practice were mainly acquired by observation (58.6%). Only 16.6% had been trained on food hygiene. Prepared fruits were not handled with bare hands, and were covered (90%). Dustbins present (90%); Poor waste disposal (40%); dirty (67%) and cracked (87.0%) work surfaces, unwashed fruits (18%); unwashed hands (52.6%); no aprons (53.9%); present jewelry (73.7%); handling of money (40.0%) and no utensils drying racks (44%) were observed. Conclusion: FHK was low and FHPs were poor. Periodic hygiene training and policy on ready-to-eat food vending should be implemented.

Keywords: minimally processed fruits, food hygiene knowledge and practices, street food vendors, microbial contamination

ST2-7-004S: Analysis of Microbial Load of Foods Prepared and Served in TVET and University Hospitality Schools in Kenya

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The purpose of this study was to analyze the microbial load of foods prepared and served in TVET and University schools in Kenya. Laboratory tests were carried out to determine microbial load of bacteria in vegetables served in TVET and University hospitality Schools training Food and Beverage management (F & B). Specific vegetables used in the study included spinach, coleslaw (cabbage and carrots) and vegetable macedoine (turnips, French beans, carrots and peas). The tests sought to isolate and identify common microorganisms such as E. coli, Shigella, Salmonella and Pseudomonas. The bacterial load ranged from 2.63×10⁵ to 4.40×10⁵. The maximum permissible coliform count according to Gulf standard (2000) ranged between 1.8×10⁴ to 2.6×10⁴. Based on these observations, it was concluded that foods prepared and/or served in these institutions are contaminated based on the lab results which showed significant amount of microorganisms in the analyzed samples of vegetables. The study recommended that training institutions should make it mandatory for all food-handling personnel to adhere to specific personal hygiene standard when working in food production workshops.

Key Words: Microbial load, Hazard Analysis and Critical Control Point (HACCP) principles, TVET, University hospitals schools

ST2-7-005S: Assessment of food handlers’ knowledge on food safety management in selected star-rated hotels in Eldoret town, Kenya.

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Background: Food safety is a critical issue facing the foodservice industry today and it affects both developed and developing countries alike. More than 200 known diseases are transmitted through food and it has been estimated that each year 1.8 million people die as a result of diarrheal diseases, most of which can be attributed to contaminated food or water. Up-to 70% of diarrheal diseases may be caused by contamination through unhygienic food handling practices, infected food handlers and lack of appropriate knowledge on foodborne diseases by food handlers. Therefore food handlers play a major role in Food Safety Management (FSM) and an understanding of their knowledge on food safety management is of paramount importance. Objectives: The purpose of this study was to assess food handlers’ knowledge on selected aspects of food safety management in selected star-rated hotels in Eldoret Town, Kenya. Method: The study adopted a cross-sectional descriptive research design. Twelve star-rated hotels in Eldoret town were purposively selected to Kenyatta University laboratory in labeled plastic bags and placed in cooler boxes with ice. Upon arrival in the lab the samples were recorded in a register and given unique lab reference codes, which were later used as sample identification during analysis. Using 36 samples of various types of vegetables collected from the institutions, lab analysis showed that microbial loads were very significant, at 0.05 levels. In fact, both paired and one sample t-tests yielded similar results; confirming that the microbial loads was significant. The tests also confirmed that microbial loads in the foods prepared and served in the institutions varied. Microorganisms that were isolated in the food samples included E. coli, Shigella, Salmonella and Pseudomonas. The bacterial load ranged from 2.63×10⁵ to 4.40×10⁵. The maximum permissible coliform count according to Gulf standard (2000) ranged between 1.8×10⁴ to 2.6×10⁴. Based on these observations, it was concluded that foods prepared and/or served in these institutions are contaminated based on the lab results which showed significant amount of microorganisms in the analyzed samples of vegetables. The study recommended that training institutions should make it mandatory for all food-handling personnel to adhere to specific personal hygiene standard when working in food production workshops.

Key Words: Microbial load, Hazard Analysis and Critical Control Point (HACCP) principles, TVET, University hospitals schools

ST2-7-005S: Assessment of food handlers’ knowledge on food safety management in selected star-rated hotels in Eldoret town, Kenya.
and all 106 food handlers in the hotels were recruited into the study through census. Data was collected by use of self-administered structured questionnaires and analyzed with the help of Statistical Package for Social Sciences (SPSS) version 21. The descriptive statistics have been presented in percentages, tables, and figures. 

**Results:** The findings revealed that knowledge on FSM was high especially on personal hygiene issues (90%). However, there was inadequate knowledge on cross contamination control (50%) and temperature control (39%) related issues. **Conclusion:** The study concludes that generally there is an acceptable level of knowledge on food safety management among the food handlers. However, the study recommends training on FSM to cover more issues on cross contamination control and temperature control and further, the training should target all food handlers at all job levels in the hotel and finally, a thorough orientation plan on FSM should be in place to all new employees who handle food.

**Key Words:** Food safety management, Food handlers, Star-rated hotels

**St2-7-006s:** State of the Kitchen Physical Environment in Ensuring Food Safety Management in The Hospitality Industry

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**Background:** With the ever growing world population, food safety is becoming more important as more people opt to eat out. Complying to food safety regulations is therefore important as its failure can result in the transmission of foodborne illnesses which is estimated to cause 33 million deaths annually. Food safety therefore needs to be applied and monitored at each stage of the food supply chain and the kitchen, being the last stage in the supply chain before the food gets to the customer (fork) is very critical in ensuring food safety. **Objectives:** The objective of the study was to assess/investigate the state of kitchen physical environment in ensuring food safety management in selected hotels in Eldoret Town, Kenya. **Method:** This was a qualitative study that employed a cross-sectional descriptive research design. Eight conventional hotels in Eldoret Town were purposively selected for the study. Data was collected by use of observation checklist to carry out an assessment of the physical environment of the hotels in ensuring food safety. The observation check list included assessment on kitchen physical environment in terms of promoting four of the five keys to safer food by World Health Organization: keep clean, temperature control (in both cooked and raw storage), cross contamination control and thorough cooking of food. Special emphasis was put on observing the availability and the condition of equipment to help manage food safety in the facilities. **Findings:** The study findings revealed that only 20% of the hotels had sinks for hand washing with soap and hand drier to enable the workers wash their hands as they work. 20% did not have separate areas for preparing different foods, more than 50% did not have proper storage temperatures and did not store raw and cooked foods separately while only 20% held foods at correct temperatures. Furthermore, none of the hotels had a probe thermometer to check the internal temperature of cooked foods. Similarly, none provided gloves for use when handling ready to eat food items such as salads and juices. However, 90% of the hotels had good work surfaces made of stainless steel and were well lit and ventilated. **Conclusion:** The study concludes that necessary measures should be put in place by the regulatory bodies to ensure that all hotels comply with the laid down regulations in the design and furnishing of hotel kitchens.

**Key words:** Kitchen, Food Safety Management, Eldoret

**ST2-7-008S:** Assessment of Hygiene Practices and Microbial Contamination of Street-vended Foods in Kenyatta University’s Environments

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**Background:** Street-vended foods are ready-to-eat foods and beverages which are prepared and sold by vendors in towns, public places, in institutions including those of higher learning. Vending of street foods is on the increase in developing countries and play an important role in meeting the food requirements of urban dwellers. This notable increase in vending street foods is attributed to urbanization and need for urban folk to fulfill the demands for work and school. University students find these foods affordable and easily accessible. However, WHO has established that street-vended foods are a major threat to public health because of their microbial contamination. **Objectives:** This study sought to investigate microbial safety and hygiene practices in the vending of street foods in Kenyatta University’s environs and to raise awareness among students on the dangers of consuming these foods. **Methodology:** Both cross-sectional and experimental designs were adopted in this study. A total of twelve (12) food samples were collected from four (4) major vending stalls at KM shopping center which is frequented by Kenyatta University students. The selected foods for analyses were sausages, samosas and kachumbari. These foods were collected and transported in cooler boxes to the Microbiology Laboratory at Kenyatta University within 3 hours.
for analyses. Standard microbiological methods were used for enumeration of Salmonella, coliforms and Escherichia coli. Results: No Salmonella was detected per 25g in all food samples tested. E.coli whereas samosas and sausages tested negative. Kachumbari, from all vending stalls, had total coliform levels $4.12 \log_{10} \text{cfu/g}$, $4.26 \log_{10} \text{cfu/g}$ and $4.21 \log_{10} \text{cfu/g}$, that did not meet the quality standards $(4.00 \log_{10} \text{cfu/g})$ of ready-to-eat foods. Total coliform counts were below detection limits in samosas and sausages. All (100%) the vending stalls were exposed to potential contaminants: none of the vendors wore protective clothing, they handled money and sold food simultaneously, and polythene bags were used for packaging take away rations. Conclusion: The street foods evaluated were safe for human consumption as per the data, except for Kachumbari. Both environmental and personal hygiene were potential contaminants. Recommendation: Presence of microorganisms in Kachumbari shows the need to improve the preparation process and training programs on environmental & personal hygiene should be developed for vendors.

Key words: Street-vended foods, microbial contamination, hygiene practices.

ST2-7-009S: Understanding The Challenges Faced By Food Vendors in Three Markets in Selected Informal Settlements in Nairobi County. A Crisis or Opportunity?

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Background: Proper planning of urban space in many informal settlements in Africa continue to present challenges especially among the socio-economically disadvantaged residents. In particular, food vendors in informal markets face many livelihood risks attributable to the legal, physical and socio-cultural environment in which they work. This is despite their important role in ensuring food safety through the chain of production, storage, processing, preparation and retailing. The number of food vendors and consumers in informal markets is on the rise with urbanization, and hence their challenges need attention by the authorities and in particular the county governments. Sanitation and hygiene is especially a factor of concern. Objective: To assess the level of practice of food safety among the food vendors in markets from three selected informal settlements in Nairobi County: Githurai, Kibera and Kayole settlements. Method: A cross-sectional survey design by use of photography was employed. Systematic sampling by category of food value chain: production, processing, marketing and preparation/consumption was used to sample 500 photographs taken from three informal settlements; Githurai (168), Kibera (166) and Kayole (166). From these, themes and sub themes were drawn and a discussion generated using qualitative approaches. Results: Urban agriculture was practiced with vegetables grown using sewerage water. In most vendor shops popularly known as “kiosks” or “kibanda”, we found that food vendors still embraced the traditional processing methods used in food preparation, food was handled and stored under elevated temperatures and poor personal hygiene practiced by food handlers. Our findings showed that there was an insufficient amount of knowledge regarding importance of safety of food hygiene and handling practices. Conclusion and Recommendations: Findings confirm that the market environment represents an important site for the spread of pathogens responsible for foodborne diseases. Targeted training about safe food handling and provision of infrastructural support (markets) by the Nairobi County government is recommended.

Keywords: Retail Food safety, Food Vendors, Markets, Informal Settlements, Livelihoods

ST2-9-001S: Factors Contributing to Food Borne Illnesses in Rural and Urban Households: A Case of Zimmerman Estate Nairobi and Kegoro village, Thika, Kenya

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Background: Food poisoning and spoilage is common in Kenyan households. Most of the food poisoning and spoilage is caused by conditions that are within the control of households. Objective: The objective of this paper is to explore the factors that contribute to food poisoning and spoilage in rural and urban households. Methodology: Review of secondary sources and interviews from selected households in Zimmerman estate Nairobi and Kegoro village, Thika provided data for this paper. Findings: External factors that contribute to food spoilage include temperature, humidity and oxygen. Intrinsis factors within the food that lead to food spoilage include acidity/alkalinity of the food, moisture content and nutrient rich foods are easier to get spoilt. Microbial contamination contributes a lot to food spoilage and poisoning. Common routes that allow microorganisms contamination include air and dust, soil, water and plants; harmful micro-organisms in the intestinal tract; food-borne microorganisms in animals and animal feeds.
Food handlers, food utensils and cross contamination between food items and contact surfaces are avenues for microbial contamination. Warm moist temperatures of storage contribute to a lot of food spoilage. Pests in food can damage and contaminate the food and unhygienic practices of persons handling food contributed to contamination. **Conclusion:** Food spoilage and poisoning is common through avenues that can be easily addressed at family or individual level if knowledge on these conditions are appreciated. **Recommendations:** Initiatives to avoid food poisoning and spoilage can be explored at household and community levels through different forums. This will enable families avoid dangers associated with food spoilage and poisoning.

**Key words:** food poisoning, food spoilage, food contamination, food borne illnesses

**ST2-3-002S: Micronutrient and Microbial Quality Assessment of Solar Dried Amaranth (Amaranthus Cruentus) Leaves Produced in Kajiado County Kenya**

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Vegetables are normally in plenty during the wet season with excess going to waste. However, there is scarcity during dry season. Vegetables can be preserved for consumption during the dry season. Solar drying is one of the vegetable preservation methods. Stored food can undergo nutrient loss and spoilage. Thus, this study aimed to assess the change in β-carotene, iron and zinc content in dried amaranth leaves (Amaranthus cruentus) with storage in air tight containers for nine months at room temperature. Atomic Absorption Spectrophotometry was used for analysis of iron and zinc while UV-VIS Spectrophotometry was used for β-carotene. Triplicate samples were analyzed for moisture content and microbial load on a monthly basis. Differences in nutrient content in dried leaves after every three months up to nine months were established by use of t-test. Results show that, the content of β-carotene, iron and zinc in fresh amaranth leaves was 5.75 ± 0.04, 8.47 ± 0.05 and 3.18 ± 0.04 mg/100 g, respectively. These levels changed to 4.46 ± 0.04, 7.98 ± 0.02 and 3.03 ± 0.03, respectively with solar drying, but the change was not significant (P>0.05). With nine months of storage, the concentration of β-carotene, iron and zinc remained relatively stable as shown by a small fluctuation which was not significant (P>0.05). Coliforms, E. coli, S. aureus, salmonella and yeasts were absent. The levels for moulds were within the acceptable levels. Solar drying can be adopted as a vegetable preservation method due to minimal nutrient loss while microbial levels were within the acceptable levels. Thus, excess vegetables can be preserved to fill the seasonal gap.

**Key words:** Micronutrient, microbial quality, solar drying, amaranth leaves

**ST2-4-001S: Banana ripening in Kenya: some safety considerations**

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The importance of fruits in human nutrition needs not be over emphasized. Fruits supply vitamins, sugars, minerals, protein, cellulose, fibre, water, and various photochemicals which protect human body against various disorders. Given the rising cases of obesity, diabetes, cardiovascular and cancer diseases globally, fruits consumption has been associated with limiting the harmful effects of such diseases. However, the nutritional value of fruits is threatened by some malpractices in checking and hastening their ripening. A wide literature review on chemicals used to delay and hasten fruit ripening was conducted. Focus was given to potential compromise on nutritional value of banana resulting from applications of selected checking and hastening ripening substances in Kenya. Although the list of literature reviewed is not exhaustive, important lessons were derived. The reviewed literature indicated that the chemicals usually used as fruit ripening agents include; calcium carbide, acetylene, ethylene, propylene, ethrel, glycol, and ethanol. Calcium carbide is the most commonly used in ripening bananas. Other calcium salts such as calcium ammonium nitrate, calcium chloride and calcium sulfate are used to delay fruit ripening. Treated bananas have appealing characteristics including; firmness, longer shelf life, uniform and attractive yellow colour when ripe. However, the consumption of bananas ripened using calcium carbide was associated with health problems such as headache, dizziness, mood disturbances, sleepiness, mental confusion, memory loss, cerebral edema, seizures and prolonged hypoxia. This paper attempts to inform the stakeholders – farmers, traders, consumers and policy makers of the potential health hazards resulting from use of artificial chemicals in delaying and accelerating ripening in bananas and other fruits in Kenya. It is hoped that by creating awareness, every stake holder in the banana value chain could become vigilant in ensuring quality in fruits we eat. Farmers and traders would be more careful in chemical use in production and ripening of bananas. The government could come up with standard fruit ripening techniques.
The concerned food safety authorities could devise effective action plan to check malpractices in delaying and accelerating banana ripening. Consumers would become keen in choosing quality as well as observing precautionary measures such as washing bananas and other fruits before eating.

**Key words:** Bananas, ripening, calcium carbide, health hazard

**ST2-6-003S: Consumer food safety aspects in replacement of Monosodium Glutamate with Single Cell Proteins for as flavoring agent in food industry.**

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Monosodium Glutamate (MSG) is a popular synthetic food flavoring agent referred to as flavor enhancer in commercial terms. A review of the current literature on replacement of MSG with Single Cell Proteins (SCP) has shown increased misuse of SCP in the food industry with consequent harmful effects to the consumer. Currently, MSG is used in a wide range of foods such as processed foods, meat stews or gravies to increase their meaty flavor. However, scrupulous manufacturers have sometimes ended up using excess MSG in food products to increase their profits. Single Cell Proteins refers to crude or refined proteins produced by mass production of food grade bacteria, yeasts or molds on industrial scale for human or animal consumption using substrates such as ethanol or whey. Bacteria and yeasts that produce SCP have fast growth rate and tend to have high concentrations of nucleic acid especially Ribonucleic Acid (RNA). Breakdown of purines from RNA leads to increased blood plasma concentration of uric acid which causes gout and kidney stones. Industrial revolution has also led to growth of large cities whose food requirements have overtaken world food production. SCP has similar properties to MSG due to high levels of glutamic acid. SCP use as a replacement for MSG has been on increase in the food industry to eliminate the use of MSG in the product or to conceal the level of flavor enhancer used in the product. Similarly, manufacturers are able to label their product as ‘organic’ or as containing only natural ingredients. SCP has many advantages but some shortcomings have stopped it from global utilization. Controlled cultivation of SCP microorganisms should also be done to avoid contamination with harmful species which produce mycotoxins and cyanotoxins.

Government of Kenya should have firm policies for food industries on production and utilization of SCPs to avoid harmful effects to consumers

**ST2-7-003P: Hygiene Practices in Kenyan Restaurant: A Critical Review**

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**Background:** A Study conducted by (WHO, 2000) indicates that approximately 70% of food borne illness are due to contaminated food. While food borne diseases are more than is recorded by public health in Kenya, majority of the reported cases are attributed to poor handling practices of foods in restaurants. Restaurants are characterized by large number of ingredients and menus which often changes. Also restaurants have no particular conditions and commodities unlike food processing plants. **Objectives:** Little research has been done on food handling practices in Kenyan restaurants. In this article therefore we summarize the research on hygiene practices in Kenyan restaurants. The paper also aims to draw the attention of relevant restaurateurs to the need to address such practices and consequently take necessary action. **Methodology:** Articles were chosen from Wiley Library online, research gate and web of Science data bases. 100 articles were screened and 10 described food handling practices in food Service industry. Only 5 articles were specific to restaurant. **Results:** Inadequate food safety inspection, lack of food safety system based on HACCP principles, cross contamination of raw and cooked foods, contaminated equipment, inadequate cooking and poor personnel hygiene were the major cause of food contamination. **Conclusion:** The findings are important in addressing practices that promote contamination of food served in restaurant hence reducing the burden of illness associated with food borne pathogens. **Key words:** Food handling practice, food handlers, restaurant, food borne diseases.
ST2-7-007P: Food Safety and Nutritional Concerns of Street Foods in Urban Centers In Kenya. A Review.

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Vending street foods is a major food industry in Kenya today, providing food and nutrition especially to the urban population. With the changing times, we find a societal consumption habits being transformed to that of acceptance and consumption of street foods more so, by the young job seekers, working mothers and the general urban population who leads a fast life and need affordable food at their convenience.

However very little information regarding the safety and nutritional value of the street foods in Kenya, is currently available. Low levels of environmental sanitation in the urban low income areas and poor handling, preparation and storage of street foods by vendors compromises safety of these foods. In Kenya the street food trade is not officially permitted or licensed. Vendors are often harassed and constantly on the run form authorities, leaving them with little time to uphold food safety and good nutrition practices in their trade. This notwithstanding, many of them operates on limited basic food hygiene knowledge, coupled with lack of safe water and storage facilities. Moreover, consumers hardly demand for safe and nutritious foods, a situation that increases the risk of infections and non-communicable diseases among the consumers. This review paper therefore aims at addressing the issue of safety and nutritional concerns of street foods in urban centers in Kenya. A search using terms such as street foods and nutrition, street foods and food safety, street foods and non-communicable diseases, and street foods and food borne diseases was conducted and analyzed. Original researches, review papers and journal articles were reviewed. This paper is therefore a review summary of literature report on safety and nutritional standards of street foods in urban Kenya, challenges faced by the industry and recommendations to governments, policy makers and consumers in general on the best way forward in ensuring the street foods are safe and of high nutritional value for optimal nutrition and health.

Key words: Street foods and nutrition, Environmental sanitation and hygiene, Safe food handling and storage, Street foods and non-communicable diseases.

ST2-8-001S: Nutraceuticals: An Emerging Trend in Nutritional Care

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Background: Nutraceuticals are regulated as dietary supplements and functional foods and are beneficial in the management of a wide range of chronic diseases and disorders. The aim of this review is to analyse the use of nutraceuticals as an emerging trend in nutrition.

Methodology: A systematic analysis was carried out using PRISMA as the reporting tool where six databases were searched, including PUBMed, Science Direct, African Journals Online (AJOL), TRIP Database and MEDLINE. Data on the use of nutraceuticals in nutritional care was extracted. Results: Globally, the consumer’s focus has shifted from treatment to prevention centred health-care due to the rise of Information, Communication and Technology. A shift in information access has changed how consumers approach healthcare. Medical information that was once a preserve of healthcare workers is now accessible to the consumer who is increasingly curious on the role that supplements play in disease management and prevention. There is increasing evidence backing the use of nutraceuticals as part of medical care. In Kenya use of chromium as a supplement in type two diabetes was found to increase the chromium levels of the intervention group to normal level of 0.3 ng/ml registering a significant reduction in HbAlc levels. A Ugandan study that supplemented children with severe acute malnutrition presenting with diarrhoea in an out-patient clinic with Bifidobacterium animalis subsp. Lactis, found that it reduced the number of days that the children experienced diarrhoea by 26% compared to the control group. An experimental study found that those who took supplements had a false sense of security and believed that the supplements protected them from their poor health decisions.

Conclusion/Recommendation: The risk of misuse of nutraceuticals is emerging as a challenge for healthcare providers since they do not easily fall into the legal category of food and drug. This makes them inhabit a grey area of non-regulation in the industry. Though a place for nutraceuticals in clinical practice is emerging, pharmaceutical, clinical and regulatory issues must to be addressed through research.
SUB-THEME 3: FOOD SAFETY POLICIES AND IMPLEMENTATION

ST3-2-001S: Development of a Food Safety Tool Kit for Dry Common Beans (Phaseolus Vulgaris L.) In Uganda Using a Hazard Analysis and Critical Control Point (Haccp) Approach

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Common beans (Phaseolus vulgaris L.) may be contaminated with heavy metals, aflatoxins, or micro-organisms. Hazard Analysis and Critical Control Point (HACCP) was proposed as a suitable program to minimise/eliminate the risk of contamination. The objective of this study was to develop a HACCP plan for common dry beans in Uganda and an accompanying food safety toolkit. The seven principles of HACCP outlined in the Codex Alimentarius were followed to develop the HACCP plan. A decision tree diagram was further used to identify each potential hazard at each processing stage and Critical Control Points (CCPs) along the chain. The identification of the CCPs was also supported by an evaluation of the actual risk and severity of the hazard. For the CCP identified, reliable control mechanism and corrective actions were established to fulfil the requirements set by the critical limits to guarantee the safety of the products. Verification and records systems were proposed to determine the effectiveness and traceability of the HACCP plan. For identified CCPs, a co-creation methodology was used to develop the food safety toolkit. This was carried out in four sessions that included a background of the chain actors’ ambitions to determine the suitability of the toolkit, assessment of CCPs, expert advice on the CCP and an exercise to develop concepts for each CCP. From the analysis, fourteen processing stages starting from land selection to cooking and serving were identified. Out of these, four stages were CCPs. These were land selection and preparation, storage, post-harvest drying, and cooking and serving. Hazards at the CCPs included heavy metals, mycotoxins, and micro-organisms such as S. aureus, E. coli, and Salmonella spp. A combination of good hygiene and sanitation practices and good agricultural practices were recommended as control measures. To further equip the value chain actors with mitigation strategies, a food safety toolkit whose usefulness is to give the actors a systematic means to control identified CCPs was developed. The toolkit and HACCP plan complement each other. From the study results, implementation of the toolkit, followed by an assessment of its uptake and impact on livelihoods and food safety risks is recommended.

ST3-2-002S: Assessment of Compliance Level To Food Safety Standards in Slaughterhouses and Meat Processing Plants in Nairobi City Council, Kenya

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Background: Meat is a highly nutritious food and popular with many consumers. To ensure wholesomeness of meat and meat products, strict meat hygiene practices have to be adhered to in all processes from farm to fork. Objectives: The purpose of this study was to assess the level of compliance to food safety standards in slaughterhouses and meat processing plants in Nairobi City County, Kenya. The specific objectives were to determine the level of understanding and use of personal protective equipment, training and identification of hazards in these facilities. Methodology: A total of 347 respondents were included in this study out of an estimated population of 2206 workers in slaughterhouses and meat processing plants in Nairobi, Kenya. Information was obtained using structured questionnaires, focused group discussions and key informant interviews. Results: Among the 347 respondents who were interviewed, 80.4% were males, their ages ranged from 16 years to 60 years with majority 88.4% being in the age range of 19 to 50 years. On duration worked 69.7% having worked for 5 to 20 years. Majority (88%) was workers and had attained secondary school education while the managers and supervisors (12%) in all facilities had attained diploma level of education. Meat inspection was carried out by qualified staff in all facilities. Food safety inspections were carried out in all enterprises to facilitate annual licencing. All workers in the enterprises wore personal protective equipments to work and had adequate knowledge on their use. However, only workers in Export slaughter houses and meat processing plant were provided with with personal protective equipments, the others had to buy there own as a work condition. Training of workers on food safety issues was offered annually to managers and supervisors in all enterprises while the other workers only receive training on recruitment or introduction of new machinery. Only 65% of the respondents, with 86.8% from export slaughter
houses were aware of the legal instruments governing the safety of workers. Safety and Health committees were more pronounced in export and meat processing plants than local facilities ($\chi^2=23.38; p<0.05$) and this was also noted in the safety and health policy ($\chi^2=38.41; p<0.05$). Hazard identification was carried out by the safety and health committees in their respective enterprises, only 30.5% of the respondents were aware of this exercise with the rest not being aware. Ranking of the hazards identified high priority hazards to include: use of sharp knives and pangas, violence from fellow workers and slippery floors during operations. Zoonotic diseases and moving vehicles scored moderate priority while the use of machinery, animals and working environment were assigned low priority. The mean score of hazardous condition ranged from 5.632 to 10.363 with the highest being in Category C Local slaughterhouses. Only 30.5% of the respondents were aware that risk assessments are carried out in their facilities. **Conclusions:** Basic standards of hygiene were maintained in all facilities. Most of the workers were mature and had attained good level of education and understood the need and use of personal protective equipments. However, workers in Category A and C slaughterhouses who had to purchase their own personal protective equipments were not able to afford a change of clothing on the same day. Basic training in food safety was traditionally offered to managers and supervisors with majority of the workers receiving no further training. Except for workers in the export slaughterhouses and meat processing plants, majority of the workers were unaware of the legal instruments governing operations in their facilities or specific operations that have a bearing on food safety which may compromise their level of compliance. Zoonotic diseases were not high priority which implies that meat from these facilities is generally wholesome and fit for human consumption.

**Key words:** Slaughterhouses, Meat processing plants, Workers, Food safety, HACCP

**ST3-2-003S: Role Of Food Safety Management Systems On Food Hygiene Practices In 5 Star Hotels In Nairobi, Kenya**

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**Background:** In the recent past, there have been press reports of a number of cases related to food borne illnesses in upmarket hotels that have generated and increased the visibility of food safety in all public eating places. Food Safety for guests in hotels and restaurants is not only of critical importance for the wellbeing of guests but is also important for the long-term economic survival of the food service operation. **Objective:** The aim of this study was to assess the influence of food safety management systems that are in place, to ensure the safety of customer foods in 5-star hotels in Nairobi County, Kenya. **Methodology:** A census of the eight 5 star hotels in Nairobi, county, was used, while the respondents were randomly identified from purposely selected key departments Data was collected using questionnaires and interview schedules. The T-test, ANOVA and Chi-square were used to measure associations and determine strength of these associations. Paired t-test results established that there is a statistically significant change in the degree of food safety as a result of implementing relevant food safety systems. **Results:** The results reveal that there exists a strong relationship among the selected predictors and provision of safe food as indicated by the correlation coefficient of 75.2 %. From the findings, the study concluded that the compliance to food safety systems and implementation of food safety system impacts positively on the provision of safe food in hotels. The regression results indicated that the predictor variable of HACCP implementation explained 68% ($R^2 = 0.683$) of the dependent variable (food safety), among other measures, followed by food hygiene rules such as washing of hands 42% ($R^2 = 0.421$) separating raw and cooked 56% ($R^2 = 0.562$) disposing of waste 33% ($R^2 = 0.333$). **Conclusions:** The study, therefore, recommends and focuses hotels on the identified key activities (predictors) that ensure the implementation of HACCP and its principles are adhered to and that the recommended food safety standards are in place. A range of laws, acts, regulations, norms and directives addressing the different aspects of food hygiene and safety, be enforced by the relevant authorities in Nairobi City County. The identified predictors should, on the other hand, encourage the formulation of better food safety policies and laws that both the central and county Governments can use to ensure safer dining. Further research could be conducted on the management systems on food hygiene practices of small and medium sized hotels in Nairobi and elsewhere, as this study focused mainly on the five star hotel populations in Nairobi County, Kenya.
Background: Food safety is the reasonable certainty that no harm will result from food consumption or related exposure. Although current global trend in agricultural systems is to produce enough food, access to sufficient and safe nutritious food remains a challenge. Farmers’ food safety knowledge, through behaviour change communication programmes, and not only literacy levels, can, in combination with other efforts, address food safety concerns by triggering prompt preventive and corrective actions. Objective: To identify knowledge gaps in promoting behaviour change communication in food safety among farmers in selected counties in Kenya. Methods: A cross sectional survey conducted among 259 farmers randomly sampled. A questionnaire and a focus group discussion guide were used to collect data. Pearson’s Chi-square test was used to establish significant differences at p<0.05. Results: Respondents average age was 42.0±3.1 years. Half of them (57.5%) had only primary education. About 95.0%, 80.6% and 36% of them owned useful communication tools; mobile phones, radios and TV set respectively with no significant differences across counties (p>0.05). Only 21.6% of respondents had received information/training on food production in previous 6 months. Main source of information was agricultural extension officer (33.9%), NGOs (30.4%), farmers’ cooperative societies (23.2%) and electronic media/TV/radio (12.5%). Books and print media were hardly used (1.8%). About 37.5% respondents were aware of agrochemicals harmful to human health. Precaution measures in handling and use of agrochemicals included; consumption/harvest of sprayed food after some time (19.7%), wear protective clothing/masks (71.0%), storage precautions (32.0%), buy chemicals from registered agro-vets (9.3%), observe certain spraying time e.g. mornings (13.5%) and consume certain meals after use e.g. milk (14.3%). About 69.1% of them knew moisture/rain on food leads to moulds which cause aflatoxins while 40.0% knew that incomplete drying of harvested food and poor storage leads to aflatoxin causing moulds. 75.7% of them knew that it is wrong to feed livestock on rotten/aflatoxin infested cereals while 72% knew health dangers of aflatoxin to humans. Focus group discussions showed farmers lacked and needed training and knowledge on food safety. Conclusion: Food safety knowledge gaps are evident in food production and addressing those gaps is recommended.

Key words: Farmers, Food safety, Agro-chemicals, Aflatoxins, Knowledge, Health

The Right to Food is one of our economic and social rights, which the State is required to take steps to achieve. As a State Party to the International Covenant on Economic, Social and Cultural Rights (ICESCR) and under Article 43 of the Constitution of Kenya, the government has the obligation to ensure that every Kenyan has the right to be free from hunger, and to have adequate food of acceptable quality. Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. In addition, the essential elements of the Right to Food include availability, accessibility, adequacy, and affordability of food. Adequate food means more than simply caloric quantity. It means sufficient nutritious food – free from unsafe substances and acceptable within the culture. It follows that the Right to Food and food security, cannot therefore be achieved without food safety. The lack of accountability and action from relevant government bodies and stakeholders in these and other instances affect the health status of the nation. The lack of access to adequate (safe) food for millions of Kenyans is unacceptable and goes against the constitutional provision of the Human Right to Food. The Route to Food Initiative (RTFI) is a programme working towards realizing the Right to Food in Kenya. Our activities aim to influence the political approach to food security and target avenues related to policy development and implementation at national and county-level. Additionally, the initiative relies on creative communications and an influencer-led campaign to promote innovative solutions to the problem of food insecurity. We engage with mainstream and alternative media to shift the emphasis of hunger and unaffordable or inadequate food to a discussion about food rights. Through the Initiative a Route to Food Alliance has formed. Through participation in the conference, we aim to create awareness on the importance of food safety in ensuring food security and securing Kenyan’s Right to Food.
Background: The right to food is a universal inalienable human right. Although it is provided for in the Kenyan Constitution, it is not actualized for many. The urban poor are particularly negatively affected, with over 80% of households in Kenya being food insecure. Food safety is a key component of utilization as a pillar of the food security framework. The right to food cannot be actualized without focus on food safety.

Methods: Through a Fellowship from the Wellcome Trust, the African Population and Health Research Center (APHRC) is implementing the “Right to Food Project” over two years from January 2018 to December 2019. The core objective is to stimulate dialogue on the nexus between the right to food as stipulated in the international legal framework and the Bill of Rights in the Kenyan Constitution, and the lived experiences with food insecurity among urban poor populations as evidenced by research. The project is being undertaken in Nairobi. We have used innovative participatory methodologies including photovoice, digital storytelling, participatory mapping, community dialogues and focus group discussions among others.

Results: Framework analysis was applied based on the food security framework. Data revealed vulnerability to consumption of contaminated, poor quality, unhygienic, poorly handled food, poor sanitation and food environment. Some eat scavenged food from dumpsites. Some food is grown with untreated sewer water, putting people’s health at risk.

Conclusions: Poor status of food safety and inequality in access to food for the urban poor due to poverty, with economic access to quality food being a major challenge was revealed. We plan to engage decision/policy makers, academia and the general public using the outcomes of the engagement towards actualization of the right to food as envisaged in the Universal Declaration of Human Rights.

Key words: Urban poor, Nairobi, Food Security, Food Safety, Right to Food

ABSTRACT

Background

In Sub-Saharan Africa, food contamination continues to wreak havoc. In this region, ready-to-eat foods are majorly sold by street food vendors where hygiene becomes a major challenge given the inadequate supply of portable water. Large numbers of unlicensed vendors operating their businesses in hard to reach areas, mostly after-work hours, thwart the efforts by the public health inspectors to ensure safe food for the public. Agrochemical use in food production is at an all-time high posing the risk of pesticide residues in foods. As health records indicate, food poisoning and foodborne illness cases are on the rise in the region. These food safety challenges will only worsen the global food crisis given the food supply deficit in most parts of the world.

Methodology

This is a cross-sectional desktop review of peer-reviewed journals, survey reports, and records from both government and private health facilities documenting food poisoning and foodborne illness outbreaks in Sub-Saharan Africa. Books on microbial physiology and metabolism have been used to highlight how to deal with the causative microorganisms.

Findings

Aetiological agents of food poisoning and foodborne illnesses can be broadly categorized as pathogenic and toxigenic bacteria, parasites and viruses. Incrementally, chemical contaminants and allergens that may find their way into food also play an important role. Unhygienic handling and deliberate contamination of food can be classified as human factors that also contribute to the problem.

Recommendations

To address these issues, all the stakeholders in the
food value chain should be involved. Food safety policies should promote surveillance and encourage players to adopt standards geared towards ensuring food safety. Training should be regularized to ensure players can monitor food safety and report outbreaks early for containment. Multi-sectorial approach should be adopted to address challenges of policy implementation. Inter-departmental synergy is instrumental in addressing the current challenges.

**Key words:** Risk factors, Food safety, Food contamination

**ST3-5-20S: Efficient Student Industrial Attachment Programs to Enhance Food Safety: A case for the Kenyan Education System**

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**Background:** Food safety and productivity rely on the relevant expertise. There is widespread concern about the deteriorating food safety and productivity in Kenya. This has cast aspersions to the quality of expertise of Kenya's agriculture graduates. **Objective:** This review was done in preparation for a baseline survey to document the status of agriculture student attachment, as a basis to develop a standard guideline for an efficient student industrial attachment program. **Methodology:** A desk-top review of journals and reports published by relevant government and non-government institutions was done. They include the Association for Development of Education in Africa's report, 'The 2014 Kenya Country Report on Youth Unemployment' which found that the country's labor market is characterized by inadequate employment opportunities. Kenya's National Treasury's "Education Sector Report for the Medium Term Expenditure Framework 2018/19-2020/21" revealed a disconnect between training and industry requirements, hence the high rates of unemployment and low productivity.

A study published in Malaysia’s “Latest Trends on Engineering Education” journal, titled “Enhancing Employability Skills through Industrial Training Program” gives a list of employability qualities. **Results:** The review shows that Agriculture students in Kenya are no longer assured of an effective industrial attachment. It articulates the link between poor quality graduates coming out of training institutions and food safety. It argues that the use of synthetic pesticides and fertilizers in agriculture brings about food safety concerns, and that agricultural expertise is crucial to the ambition of reducing synthetics through scaling up agro-ecology, as well as ensuring their safe use where used. **Conclusion:** It concludes that the hope for transformation of Agriculture in Kenya for food safety relies on a transformation of the teaching curriculums, especially the Agriculture Student Industrial Attachment Programs, as well as routine quality assessments of all foods in trade.

**Key words:** Agricultural expertise, agro-ecology, industrial attachment, food safety

**ST3-5-023S: Human Exposure to Radiation from Consumption of Cassava in Kilimambogo, Kenya**

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**Background:** The levels of naturally occurring radionuclides present in the environment vary from place to place depending on the geology of the area. \(^{226}\)Ra, \(^{232}\)Th and \(^{40}\)K in the environment easily get into the food crops through root uptake from the soil and finally through ingestion of either food crops or water. Ingestion mainly occurs when the radionuclides present in the environment enter the food chain. The contamination occurs directly where the radionuclides are deposited on the above-ground parts of the plants or indirectly where radionuclides are taken from the soil by the root system of plants through the sorption process. Uptake of radionuclides by plants from soil is characterized by transfer factor; the ratio of the radionuclides in plants to that in soil. These radionuclides may pose a serious health threat if significant quantities are inhaled or ingested. Ionizing radiation emitted as these radionuclides decay may affect atoms in living cells and may damage the DNA material, which if not repaired correctly, a cell may die or eventually become cancerous. The aim of this research was to determine the distribution of primordial radionuclides in cassava tubers, and leaves as well as the soil samples from Kilimambogo region in Kenya. **Materials and methods:** The cassava samples were washed clean, cut into small pieces, sun and oven dried and then ground. The soil samples were ground, oven dried and sieved. The activity concentration of \(^{226}\)Ra, \(^{232}\)Th and \(^{40}\)K in the samples were measured using Thallium activated Sodium Iodide, NaI (TI) detector.
Results: The mean activity concentrations of $^{226}$Ra, in tubers and leaves were $40 \pm 5$ Bq kg$^{-1}$ and $41 \pm 6$ Bq kg$^{-1}$, that of $^{232}$Th were $105 \pm 13$ Bq kg$^{-1}$ and $68 \pm 9$ Bq kg$^{-1}$, while that of $^{40}$K were $459 \pm 13$ Bq kg$^{-1}$ and $484 \pm 41$ Bq kg$^{-1}$ respectively. These values exceeded the world average of $33$ Bq kg$^{-1}$, $45$ Bq kg$^{-1}$ and $420$ Bq kg$^{-1}$ for $^{226}$Ra, $^{232}$Th and $^{40}$K. The mean activity concentrations of $^{226}$Ra, $^{232}$Th and $^{40}$K in the respective soil samples were $41 \pm 17$ Bq kg$^{-1}$, $59 \pm 4$ Bq kg$^{-1}$ and $594 \pm 12$ Bq kg$^{-1}$. The transfer factors for all the radionuclides in cassava tubers and leaves to that in the respective soil samples were determined. $^{40}$K recorded the highest mean leaf-to-soil ratio of 1.45. The transfer factors for all the radionuclides in cassava tubers and leaves to that in the respective soil samples were determined. $^{40}$K recorded the highest mean leaf-to-soil ratio of 1.45.

Conclusion: The mean annual effective dose received from the consumption of cassava tubers and leaves was $3.45 \pm 1.20$ mSv y$^{-1}$, ranging from 1.72 to 5.25 mSv y$^{-1}$ and 0.75 to 0.30 mSv y$^{-1}$ and ranging from 0.37 mSv y$^{-1}$ to 1.20 mSv y$^{-1}$. This gives a total exposure of $4.20 \pm 1.23$ mSv y$^{-1}$ which is four fold higher than the 1 mSv y$^{-1}$ recommended by the International Commission on Radiological Protection (ICRP) for the general public.

ST3-5-025S: Acceptability of Oyster Mushroom Enriched Millet Porridge among People Living With Hiv/Aids (PLWHAs), Kenya

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Background: Studies have shown mushrooms to contain high levels of antioxidant compounds that promote the immune function of the body. This knowledge has triggered initiatives to develop pharmaceuticals and nutraceutical products from mushrooms in Africa; specifically “immuneassist” and “kay biotics” in Ghana and Cameroon respectively. Millet is an indigenous crop in Kenya and is reported to have a high concentration of nutrients that promote health and improve the immune status. Millets are reported to have high tolerance to low application of soil nutrients, temperature fluctuations and are drought resistant. Antioxidants offer protection against oxidative stress in the body. People with a lowered immune system, e.g. people living with HIV/AIDS (PLWHAs) are in need of these antioxidants to prevent oxidative stress that worsens their immune functionality. Nutrition interventions have been integrated in the care of PLWHAs. However, there are limited options of nutritional therapeutic feeds available to boost their nutrition and health status. There is need to develop alternative products from locally available foods to reduce the monotony of the therapeutic diets. This study sought to assess the sensory acceptability of oyster enriched millet porridge among PLWHAs.

Methodology: Four formulations were used in the study at mushroom powder: millet flour ratios of 0:100, 10:90, 20:80 and 30:70. Forty respondents were randomly selected from Nakuru county Hospital and partially trained on sensory evaluation. A five-point hedonic scale was used to generate sensory evaluation scores and statistical analysis done using ANOVA.

Results: A significant difference was observed in mean values of the four formulations in terms of Colour (p=0.22); Taste (p<0.001); Aroma (p<0.001); Consistency (p<0.001), Flavour (p=0.001) and general acceptability (p<0.001). Results showed that the control porridge received the highest mean (4.67 ± 0.479) in terms of general acceptability. This mean reduced as the amount of mushroom powder in the porridge was increased. It was observed that aroma, taste and flavour were the highest contributors to the reduced acceptability in porridge enriched with oyster mushroom powder.

Conclusion and Recommendation: The study concludes that mushroom enriched millet porridge is acceptable among PLWHAs in controlled amounts. Based on these findings; the study recommends that mushroom enriched millet porridge be integrated to nutritional care of PLWHAs and studies to be done on improving the sensory acceptability of the porridge.

ST3-3-005S: Who Cares? Consumer Attitudes and Purchase Decisions on Peri-urban Agricultural Commodities in the Absence of Information Asymmetry

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Background: Production of urban and Peri-urban agricultural products is gaining popularity especially in densely populated urban centers such as Nairobi City. However, effective demand on such commodities may be low due to consumer attitudes related to food safety. Further, in most cases consumers make purchase decisions under information asymmetric conditions regarding the source of the vegetables they normally purchase. Objectives: The current study seeks to assess consumer attitudes towards the vegetables produced in urban and Peri-urban (UPA) agricultural systems. Further, the study assessed how elimination of information asymmetry affects consumer decisions and the determinants of the premium or discount values that consumers are willing to pay on urban and Peri-urban commodities once full information is disclosed.

Methodology: The study applied exploratory factor analysis done using ANOVA.
Food is a basic human need that plays a vital role in the sustenance of life. Its safety, however, has become a major concern to the food industry given that the consumption of contaminated food and water contributes to a myriad of health problems worldwide. Although food prepared and served at the restaurants may look clean and taste delicious, it may be contaminated by biological, chemical or physical hazards. Food workshops (kitchens) are viewed as the major sources of contaminations from poor sourcing and handling practices which include undercooking, poor personal hygiene, and use of unclean equipment, inappropriate storage and incorrect holding temperatures at the point of service. Despite extensive investment in training on food safety principles, and/or standards that govern food handling, collectively known as Hazard Analysis and Critical Control Point (HACCP), there is, however, need to assess whether students in various food training institutions are aware of such principles. The purpose of this study was to assess the level of awareness on Hazard Analysis and Critical Control Points (HACCP) principles in TVET and University hospital schools in Kenya. A total of 671 respondents participated in the study.
(Comprising 249 from universities, 250 from Institutes of Technology, 64 from Polytechnics and 128 from Technical Institutions). Primary data sources included using structured questionnaires, taking photographs, oral interviews, observation check list and focus group discussions. Secondary sources, on the other hand, involved retrieving information from desk research where journals, books and other relevant literature were obtained. Both descriptive and inferential statistics were used to analyse the quantitative data while content analysis was used to analyse the qualitative data. The analysed data were presented in terms of graphs and tables. The study found that 83% of the respondents interviewed were aware of the HACCP principles while 17% were not aware. The study revealed that (45%) respondents from Universities were aware of food safety and hygienic practices compared to respondents from TVET colleges at (38%). In testing the independence of institution category on awareness, the test yielded a $p$-value $= 0.001$, which was less than 0.05. Since the $p$-value was less than the level of significance, the null hypothesis of independence was rejected. This decision implied that there was a significant relationship between institution category and code of practice on awareness. The study concluded that even though the majority of the respondents indicated that they were aware of HACCP principles and food safety, they did not practice what they knew. It was recommended that there is need to create more awareness on HACCP principles and for food safety by holding workshops, seminars and sensitization programme to the stakeholders of hospitality industry.

**ST3-3-004P: The Role of Risk Perception as a Driver of Food Choice among Women Aged 20-59 Years in Kiambu County**

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**Background:** Food safety incidents have been occurring frequently in Kenya resulting in the enactment of various programs and policies to prevent and manage them by the Kenyan Government. Despite this, a gap still exists between individual behavior towards food choice and risk perception and available policies and information. This is mainly because consumers evaluate food choice and safety in a way that is seemingly irrational, mainly driven by different psychological and physiological factors. In developing health programs that educate the public on risk associated with consumption of contaminated food, the perception of risk by individuals would be a good indicator to assess their probable impact across the population. A study on food safety perceptions in Kenya have shown that risk perception improved across education, income and work experience. A further assessment on the extent that risk perception influences food choice in the Kenyan context is needed. **Objective:** To assess the role of risk perception as a driver of individual food choice among women aged 20-59 years with different socio-demographic characteristics in Kiambu County. **Methodology:** A researcher administered questionnaire containing sections on demographic data and the Food Choice Questionnaire will be used. To assess the role of risk perception as a driver of food choice, the participants will rank the options: Is free from genetically modified products, Is made from ingredients that I know, Has a food label and Is free from “food scare” across a five point Likert scale where one (1) will stand for “not very important” Two (2) “a little important”, three (3) “moderately important”, Four (4) “important” and Five (5) “very important”. This data will be analyzed using SPSS version 22 and described using means, percentages and standard deviation. Differences in means across socio-demographic characteristics will be analyzed using ANOVA and chi square test where a p value < 0.05 will be considered statistically significant. **Results And Conclusion:** The results of this study will create awareness on the extent that risk perception affects food choice among individuals and will inform future public health interventions in mitigating food safety incidents.

**ST3-5-001P: Added Starch and Pectin Affect Hardness of Cooked Bananas**

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Texture is an important quality attribute of fresh and processed foods. In plant foods, texture is closely related with the structural integrity of the primary cell walls and middle lamella that is mainly composed of pectic substances. Bananas mainly contain water, starch, pectin and fibre which influence texture. Cooking bananas soften on cooking but immediately harden on cooling. Despite many studies on retrogradation of starch and its effects on texture, little is known about the effect of added starch and pectin on hardness of bananas upon cooking and cooling. In this study, the effect of added...
Background: The clamping of the umbilical cord can be done at different times after delivery, although delaying the clamping of the cord for ≥ 1 minute after birth improves the haemoglobin levels for newborn babies. There is limited variation may lead to safety issues and influence birth improves the haemoglobin levels for newborn babies. There is limited variation may lead to safety issues and influence birth improvements.

Objective: To assess the nurse's knowledge aspect on enhancing haemoglobin levels of Infants through delayed cord clamping in a semi urban Hospital in South Rift Region, Kenya. Methods: The nurses participating in the study were enrolled through simple random sampling in maternity and delivery rooms and the aspect of knowledge was assessed using Pre-test questionnaire. Results: Half of the nurses (50%) had knowledge that delayed clamping is recommended. However, 69% had knowledge that delayed cord clamping should be performed for those infants requiring essential care under maximum safety conditions while 94% reported that delayed cord clamping is beneficial to the infant and does not interfere with the assessment of the baby and administration of uterine drugs. A bout 31% had incorrect knowledge that delayed umblical cord clamping increases the infant's risk of acquiring HIV. Half of the nurses (50%) had knowledge that the World Health Organization (WHO) 2014 guidelines recommended delayed cord clamping for all infants without medical complications including infants of women who are HIV positive. Conclusion: The nurse's knowledge on the optimal time to clamp the umbilical cord after delivery was not uniform. Majority of the nurses had knowledge that delayed cord clamping increases the risk of mother to child HIV transmission and aspect of knowledge affected the safety level of infant haemoglobin levels. Recommendation: Relevant stakeholders should consider developing national guidelines on and standard operational procedures on Umbilical Cord Clamping after delivery.

Key Words: Nurses, Knowledge, Safety, Haemoglobin, Cord Clamping and Time

ST3-5-003P: Hospital Malnutrition and the Nutrition Care Process for Surgical Inpatients in Developing Countries: A Review

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Background: Globally, disease related malnutrition in hospitalized patients is a major public health issue in both industrialized and emerging countries. Poor nutritional status is associated with increased morbidity and mortality, increased hospital stay, more frequent re-admission, and increased healthcare costs. The prevalence of malnutrition among hospitalized patients ranges between 20% and 50%. Good nutrition is crucial for the well-being of a patient because it involves a coordinated approach when it comes to the delivery of food and fluid. Objective: To establish validated protocols for nutrition screening and assessment and diet therapy practices among...
Low adoption and use of integrated soil fertility management (ISFM) strategy is the major cause of depleted soil nutrient, chronic food insecurity, malnutrition and prevalent high poverty levels in semiarid areas. Regardless of huge contribution by donor institutions and government development partners in sponsoring programs that embrace ISFM strategy among smallholder farms in semiarid areas such as Machakos in eastern Kenya. However, this is attributed to lack of concrete evidence at community and watershed level on benefits, as opposed to massive evidence from plot studies. A study was conducted in Mwania watershed in Machakos County from 2014 – 2018 to assess the effects of ISFM practices on soil chemical properties particularly nutrient levels and maize yields. The household data collection was undertaken using two stage sampling method to obtain a representative sample size for the study. Initial step was to delineate the watershed and number of households (HHs) picked from each sublocation was based on sampling size frame, a total of 380 HHs were obtained. Using purpose sampling method, a total of 175 house hold heads (HHHs), who were members of water resource use association (WRUA) were carefully selected and structured questionnaire administered on them, followed by soil and maize yields sampling. Descriptive statistics was performed using statistical package for Social Sciences (SPSS) and field measurements generated soil and maize yield data from 10 farm field per ISFM technology and the data was subjected to analysis of variance (ANOVA) using GenStat 15th edition.

Results showed that common combined ISFM practices by smallholder farms were: (i) Intercropping + Inorganic + Tied ridging, (ii) Intercropping + Organic + Tied ridging, (iii) intercropping + Organic + Inorganic + Tied ridging, (iv) Intercropping + Zero + Tied Ridging, (v) Monocropping + Organic + Inorganic + Tied Ridging and (vi) Monocropping + Organic + Tied Ridging. Intensive know-how, labor demand and high cost of technologies were the main factors hindering the spread of ISFM in semiarid areas. Conversely, benefits accrued when using ISFM approaches were significant on both maize yields and soil nutrients levels. For instance, t-test on changes in soil organic carbon and acidity before and after the study reported significant P values at P≤ 0.05. Similarly, maize grain yields reported ranged from 1.37-1.79 t ha-1 in reliable short rain seasons, with the highest average yields realized from Monocropping with both organic and inorganic fertilizers under tied ridges. However, overall results indicate it is more beneficial by 52.75% to intercrop during short rains than monocropping. Therefore, the study recommends pigeon pea intercrop with combination of organic and inorganic fertilizers under tied ridges for semi-arid areas.

Key words: Awareness, Adoption, ISFM and watershed

ST3-5-004P: A Curse of Nutrient Depleted Soils and Diminishing Maize Yields in Semi-Arid, Kenya; Can Integrated Soil Fertility Management technologies be the saviour?

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Methodology: The documentary research method (DRM) applied in social research was used in this review. Studies reporting data on nutrition assessment, disease related malnutrition, prevalence of malnutrition, length of stay, diet therapy and clinical outcomes with a sample size of ≥40 inpatients were eligible for inclusion. There were 25 full research articles with studies carried out in 13 developing countries / regions. Results: The methodology in the articles varied considerably as well as tools used for nutrition assessment and screening. Studies that evaluated nutritional status according to BMI had lower rates than those that used other tools. Prevalence of malnutrition ranged between 55% and 76% with the highest rates reported among patients who underwent gastrointestinal procedures followed by elderly surgical patients. Disease-related malnutrition was associated with an increase in infectious and non-infectious clinical complications and length of hospital stay. However, there was no nutritional prescription reported in the studies for the malnourished cases. Conclusion: There is an increase in the occurrence of malnutrition among surgical patients, which often goes unnoticed in the hospital setup in developing countries. Different methods have been used to assess nutritional status in hospitalized patients and there is no agreement as to which index best reflects nutritional status. There is need to distinguish between nutritional screening and nutritional assessment. Recommendations: There is need to validate and standardize nutrition screening and assessment tools for hospitalized patients. Routine nutritional screening and adequate nutritional support should be implemented in hospitals in developing countries. Team approach to the nutrition care process should also be enhanced.

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Background: African Leafy vegetables can fight malnutrition, however, those sold in markets are suspected to grow in sewages, raising food safety issues hence low consumption. To increase their accessibility and acceptability they can be grown in school gardens for consumption by school children. Methodology: Children aged 6-10 years from Kangundo and Kilalani primary schools, purposively sampled from 67 schools in Kangundo sub-county, were assigned to experimental group(66) and control group(46) and fed for 13 weeks on “githeri” and a recipe prepared from Amaranthus cruentus and Vigna unguiculata vegetables, grown in a garden in the experimental school. Those in the control only fed on “githeri” for the same period. Their baseline and endline FFM and serum Zn, Fe, retinol and β-carotene were analyzed. Anthropometric measurements, dietary practices and morbidity patterns were collected through questionnaire. Results: baseline: all children had a Z score < -1SD. Morbidity: Expt. = 40%; control =56%. 95.6 % parents earned <10,000 p.m. Indigenous vegetable consumption: expt. 15.9% control. 15.3%

Mean % FFM for control was 77.701 ± 3.89 and for expt. was 77.508 ± 4.95, no significant difference (p=0.826). Endline mean % FFM: control was 77.533 ± 3.82, exp. was 80.420 ± 4.90, significant difference (p=0.001). Baseline mean Fe (mg/L): control = 11.634 ±1.55, exp. = 11.643 ± 1.81, no significant difference (p=0.978). Endline mean Fe: control = 11.874 ± 1.45, exp. = 14.239 ± 1.80, significant difference (p<0.001). Baseline mean Zn (mg/L): control = 0.577 ± 0.10, exp. = 0.581 ± 0.15, no significant difference (p=0.843). Endline mean Zn: control = 0.584 ± 0.11, exp. = 0.712 ± 0.15, significant difference (p>0.001).

Conclusion and recommendation: Consumption of garden-sourced Amaranthus cruentus and Vigna unguiculata improved nutrition status of children. School gardens should be established to optimize production of AILVs to fight malnutrition in children in Kenya.

Keywords: African Indigenous Leafy vegetables, school gardens, Nutrition status.

ST3-5-006P: Development of a nutrient composition database for packaged food products in Kenya

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Diet-related non-communicable diseases including obesity and cardiovascular diseases are emerging as the leading causes of mortality and morbidity in Africa. The rise in chronic diseases has been strongly linked to changing structural factors such as urbanization and increasing food market globalization. One of the ways to reduce the rising prevalence of overweight, obesity and associated chronic diseases is to evaluate and improve dietary habits of the population. The aim of this study will be to develop a nutrient composition database for packaged food products that are sold in Kenyan super markets.

This project will be planned and executed as a collaboration between The George Institute for Global Health, Australia and Kenyatta University, Kenya. Data will be collected from one store of each of the four largest supermarket retailers in Nairobi - Tuskys, Naivas, Carrefour, and Quickmart, using The George Institute for Global Health FoodSwitch data collector app. Information that will be collected include
manufacturer, brand and product name; nutrients and ingredients; and any nutrition claims. Data will be entered into an electronic database according to standardized procedures. Foods will be categorized in a hierarchical structure to food groups, categories and subcategories. Mean values for nutrients will be calculated overall and separately according to food groups and food categories. This will also be compared with data from other countries. The food composition database developed from this study will enable objective and transparent tracking of packaged foods in Kenya. In addition, the information will support government policies on nutrition regulations for packaged foods.


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Background: A nation’s health outcomes and socio-economic development is dependent on the leadership and management of health programs. Good leadership has the ability to ensure stability in food security and good nutritional status of a population. As such authentic leadership becomes the best type of leadership that ought to be practiced in health sector. The healthcare industry in Kenya faces a number of challenges including; inadequate skilled health personnel, poor leadership, inadequate healthcare resources, shortage in healthcare personnel supportive mechanisms to motivate employees, and lack of teamwork among the healthcare personnel. This has resulted in poor performance within the industry. In Narok county, according to SMART survey 2018, the household food security results indicated that majority of the households (56.6%) had a poor or borderline dietary diversity score while women’s dietary diversity score was also poor with 64.7% of women taking food from less than <5 food groups in the past 24 hours. Objective: The main objective of this study was to determine the influence of Leadership and Management on Nutrition programs performance based at County health institutions-A Case Study of Narok county- Kenya. Methodology: A cross-sectional survey design was adopted to carry out the assessment in various counties. This design was appropriate in collection of both quantitative and qualitative data. The nutrition staff’s leadership and management skills and gaps including knowledge and competencies in nutrition programmes/intervention design also were determined among others. The approach included self-administered e-questionnaires, which were shared among all the nutritionist and selected key informants among the county health management team. Results: A total of 94 Nutritionist staff translating to (66%) were assessed out of 141in the five counties. Gender distribution showed females 61 (65%) and males 33(35%).Staff employment by employer showed majority of nutrition staff were county employed at 76% of total number assessed. Additionally, Nutrition staff availability in the five counties showed that there is big shortage of nutrition staff as compared to the required minimum as stipulated in HRH Norms and Standards Guidelines for Health Sector, 2014 .The staffing for nutrition cadre at the time of assessment in Narok County was 48 (34%).50% of the respondents in Narok County indicated that they had a documented mentorship and coaching framework. Further results from the assessment show key informants had done some leadership and management courses. Conclusion: All in all, in order to address the 56% gap of untrained staff in the county, the need to continue equipping the targeted staff with leadership and management skills through capacity building and mentorship is recommended. This will also address succession, leaves, and unplanned exit of staff among others. Additionally, staff shortage of Nutrition cadre in Narok county needs to be addressed by stakeholders as it hampers effective and efficient quality nutrition service delivery including food security interventions.

Key Words: Influence of leadership; Program Performance; Leadership and Management; Food Security; Key informants

ST3-5-008P: Consumers’ Experiences with Nutrition Information on Processed Meat Products in Supermarkets in Nakuru Town, Kenya.

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Background: There has been an increased effort globally to sensitize consumers to read and utilize nutrition information on processed foods. Processed meat consumption in the developed and developing world has continued to increase accounting for 58% of overall consumption. Nutrition information on the label has emerged as a prominent policy tool for promoting healthy eating in developed countries. Nutrition labels have also been shown to encourage...
more healthful diets among people who read the labels. **Objectives** of the study were to establish nutrition information on processed meat products label and to determine the utilization of nutrition information on processed meat products by consumer in supermarkets in Nakuru town. **Methods:** A mixed methods study was conducted among 422 consumers, and 9 KIs sampled from eight randomly selected supermarkets in Nakuru town. Data was analyzed using SPSS. Statistical significance was set at \( p<0.05 \). **Results:** The findings of this study revealed only one out of five of the processed meat brands in the market under study provided nutrition information on the label of its products. Most of the participants (66.8%) read nutrition information on the labels of processed meat products. Cholesterol (26.1%), sodium (17.8%) and fats (15.4%) were the nutrients of most interest to consumers when reading labels. Seventy three percent reported that the labels were useful, 18.2% that the labels were not useful. The study identified: illiteracy, understanding and interpreting technical nutrition terms, and small print size as the challenges they experience when using nutrition labels. Associations were established between utilization of nutrition information in purchasing decisions with age (chi-square 194.580; \( p= 0.013 \)), sex (chi-square 15.274; \( p= 0.049 \)), income (chi-square 224.027; \( p= 0.044 \)), and level of education (chi-square 224.027; \( p= 0.004 \)). The KIs revealed that creating more awareness through health education, media and learning institutions will improve the utilization of nutrition information among consumers of processed meat products. **Conclusion:** Most consumers utilize nutrition information on processed meat products despite it being limited. It is therefore important to put in place measures as well as policies, **regulations** and their enforcement by government of Kenya on nutrition labeling on processed foods. This can achieve substantial improvement in consumer access to health related information.

**Key Words:** Nutrition Information, Processed Meat Products

**ST3-5-009P: Malnutrition and Malnourishment**

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Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients. The term malnutrition addresses 3 broad groups of conditions: undernutrition, which includes wasting, stunting and underweight; micronutrient-related malnutrition, which includes micronutrient deficiencies or micronutrient excess; and overweight, obesity and diet-related non-communicable diseases such as heart disease, stroke, diabetes and some cancers. Malnutrition affects people in every country. Around 1.9 billion adults worldwide are overweight, while 462 million are underweight. An estimated 41 million children under the age of 5 years are overweight or obese, while some 159 million are stunted and 50 million are wasted. In Kenya for example, malnutrition is a serious public health problem that requires urgent attention. The problem since the first survey in 1977 shows an upward trend, suggesting deterioration over the years. Well thought out and targeted intervention programmes are long overdue. The recent results of a survey and others emphasize the importance of having well established surveillance system which would ensure necessary and timely action through concerned bodies. It is quite common to find undernutrition and overweight within the same community, household or even individual. Malnourishment on the other hand refers to lack of proper nutrition, caused by not having enough to eat, not eating enough of the right things, or being unable to use the food that one does eat. Many families cannot afford or access enough nutritious foods like fresh fruit and vegetables, legumes, meat and milk, while foods and drinks high in fat, sugar and salt are cheaper and more readily available, leading to a rapid rise in the number of children and adults who are overweight and obese, in developed as well as third world countries.

**ST3-5-010P: Communication Strategies used to Promote Nutritional Literacy in Kenya: a missing link in Effective Cancer Prevention and Management**

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Cancer has become a major health problem in Kenya. Research shows that nutrition plays a very important role in preventing cancer and in the healing process of a person suffering from cancer. This study sought to find out the communication strategies used to promote cancer prevention and management using nutritional information. Data was collected from cancer survivors and caregivers of cancer patients using interviews. The cancer survivors and caregivers were selected using snowball sampling. They were sampled from various counties in Kenya. Therefore the cancer patients were diagnosed with cancer and treated in public and private health facilities from across the country. For
comparative purposes, secondary data was collected from the websites of selected organizations focusing on promotion of cancer awareness, care and treatment in Kenya, South Africa and the USA. These websites were selected purposively. The study found that there are no nutritional guidelines prepared by any relevant Ministry of Health body or cancer organization in Kenya for cancer prevention and management. It was also found that many cancer patients and caregivers do not undergo nutritional screening and they are not given any nutritional information at all from healthcare practitioners. As a result, cancer patients, their caregivers and the general population rely on other sources of information including interpersonal channels, social media platforms and the Internet. Since most of these sources are not authoritative, the information they spread may be misleading and harmful. Lack of nutritional information for cancer prevention and management negatively influences prevention mechanisms and treatment outcomes.

**Key words:** nutrition, guidelines, awareness, communication strategies


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**Background:** Food insecurity and inappropriate complementary feeding (CF) practices among children 6-23 months old is common in the arid and semi-arid (ASAL) counties in Kenya. Strategies to improve CF practices have focused on provision of knowledge on appropriate CF practices. Whereas there is evidence demonstrating the association of food security and CF practices in other countries, and to a limited extent in some parts of Kenya, there is scarce information linking food security and optimal complementary feeding practices in the ASAL counties in Kenya. **Objective:** The main objective of this study was to establish the association between food security and complementary feeding practices in the ASAL counties in Kenya and make recommendations for appropriate interventions. **Methodology:** A review of over 20 studies, surveys and assessments (both quantitative and qualitative) on infant and young child feeding practices and food security in the ASAL counties in the last five years was conducted. The articles reviewed included those published in referred journals, reports of surveys by the Kenya Ministry of Health in collaboration with partners and any other relevant documents. **Results:** Food insecurity is seasonal and dependent on the type of livelihood. Whereas breastfeeding practices have improved significantly in the recent past; improvement in CF practices has been slower. Overall, over 40% of the children were fed at the recommended *minimum meal frequency and less than 40% attained the minimum dietary diversity*. The percentage of children who received a minimum acceptable diet; a composite indicator of *minimum meal frequency and minimum dietary diversity* was less than 25% in a majority of the counties indicating that most of the children 6-23 months old received a diet low in quality in terms of nutrient adequacy. Qualitative findings showed food insecurity to be a major hindrance to the attainment of optimal CF practices because of unavailability and inaccessibility of a variety of foods. **Conclusions:** Interventions to improve CF practices should take into consideration the issue of food insecurity. There is need to accelerate and upscale multidisciplinary approaches engaging nutrition-sensitive interventions, in addition to other interventions, to improve household food security and consequently complementary feeding practices. **Key words:** Food security, arid and semi-arid lands, Kenya, complementary feeding practices, nutrition-sensitive interventions

**ST3-5-012P: Evaluation Of Protein Quality of Rations For Nile Tilapia (*Oreochromis niloticus*) Containing Soybean Meal, Canola Meal and Sunflower Meal as Replacements of Fishmeal**

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This study aimed to evaluate the amino acid profile of the diets for Nile tilapia containing soybean meal, canola meal and sunflower meal as replacements of
fishmeal. Four isonitrogenous diets (30% crude protein) and Isocalorific (2900Kcal/kg) were formulated using fishmeal (FM), soybean meal (SBM), canola meal (CM) and sunflower meal (SFM) such that each contributed 10% of the 30% crude protein (CP) in diet 1, 2, 3, and 4 respectively. The amino acid profile of ingredients and diets were determined by MPA FT-NIR spectrometer (Bruker, Germany) which is a non-destructive method of analysis. Fish meal recorded higher levels for amino acid lysine, methionine, arginine, threonine and isoleucine. Substituting 10% CP of FM with either SBM, CM and SFM, reduced the levels of Isoleucine, leucine, arginine, lysine phenylalanine histidine and threonine and increased levels of methionine in diet 2. On chemical scores, fishmeal scored highest for more amino acids while diet 1 had higher chemical score. In all the diets, methionine was the first limiting amino acid and Isoleucine second limiting. Though diet 1 exhibited higher essential amino acid index, it was not satisfactory because it was limiting in methionine. EAAI reduced with replacement level of fishmeal and varied depending on the major plant protein source i.e for diet 1, 2, 3 and 4 (0.97, 0.78, 0.77 and 0.76) respectively. The study showed that substitution of 10% CP of FM with SBM, CM and SFM gave a useful protein diets.

Key words: Amino acids, Chemical score, Essential amino acid index, Protein quality

ST3-5-013P: Assessment of Food Consumption Pattern and Lifestyle Practices in Relation To Non-Communicable Diseases among Tricycle (Keke) Operators in Bauchi Metropolis, Nigeria

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Background: Regular monitoring and surveillance of food consumption and lifestyle of workers in informal sectors of any nation should be one of the strategies to adopt in minimizing the upsurge of non-communicable diseases among developing countries like Nigeria. Objective: This study was designed to assess the food consumption patterns and lifestyle practices of the tricycle operators in relation to non-communicable diseases. Material and Methods: Simple random sampling was used to select a hundred and ninety nine tricycle operators from the registered members in Bauchi metropolis. Modified Harvard food consumption Questionnaire, digital bathroom scale and stadiometer were used to gather information on food consumption, weights and heights from the operators. Digital scan devices were used to measure operator’s random blood sugar and blood pressure to determine their blood sugar and pressure levels. Results: The results indicated 49.7% were between the ages of 22 – 25 years old, while 77.7% of the operators had basic formal education and about 89.9% of the operators earned between ($4–$19) per day. The results further revealed that weekly mean consumption of basic classes of food/nutrients were (Meats: 2±2.3, Smoked fish: 2.0±0.5, Steved boiled beans: 3.0±1.0, Fried eggs: 1.0±0.5, Jollof rice: 3.0±1.0, Yam: 1.3±1.0, Ice cream: 2.4±1.0, Peanut: 4.0±0.4, fermented millet drink: 3.2±1.2, Pineapple: 2.0±0.5, Spinach: 2.5±1.0) Lifestyle and physical activity practices indicated that 69.8% of operators smoked cigarette 3times daily and more than 95% performed light physical activities daily. In addition, double burden of malnutrition was observed among the operators with 21.6% overweight and 48.2% underweight, while 65.2% had elevated blood pressure and 45.2% were diabetic. Conclusion: High prevalence of malnutrition in form of underweight, high blood pressure and high blood sugar with lack of high intensity activity and lack of relaxation may promote rise in non-communicable disease. Recommendation: There is need by the ministry of health and non-governmental organization in Nigeria to intensify their efforts in educating the public on healthy eating and healthy lifestyle practices in order to reduce the non-communicable diseases among the operators

Keywords: Consumption, Diseases, Food, Lifestyle, Non-communicable, Operators, Tricycle

ST3-5-014P: Assessment of Nutritional Management Strategy Adopted By Outpatients Living With Cardiovascular Diseases Attending Selected Bauchi General Hospitals, Nigeria

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Background: Poor management of food/nutrients consumption of cardiovascular diseases’ patients after being discharged from health facilities has contributed to regular and increased number of outpatients with cardiovascular related diseases attending General hospitals particularly from rural communities in Bauchi.
State, Nigeria. **Objective:** This study was carried out to assess the nutritional management strategy adopted by outpatients living with cardiovascular diseases in selected Bauchi General Hospitals. **Material and Methods:** Purposive sampling was used to select three hundred outpatients from the hospitals. Data collection tools used included food frequency consumption questionnaire, digital bathroom scale, stadiometer, digital glucometer and sphygmanometer to obtain information on food choices and consumption, weights, height, random blood sugar and blood pressure levels of outpatients. **Results:** The results of this study indicated 56.7% of the were male and 70.3% were more than 31 years old, while 32% of them had no formal education and 2% were single. Weekly mean food choice/nutrients consumption indicated that Fatty meat: $3.0\pm0.8$, Whole milk: $2.4\pm1.2$, Margarine: $2.1\pm0.4$, Soda: $1.8\pm0.7$, Processed Grains: $2.1\pm0.3$, Fried yam: $2.2\pm0.7$, Pasta: $2.7\pm0.9$). Physical activity data showed that 81% engaged in farm work and bicycling in at least least than 30min daily. Body mass index (BMI) of the outpatients showed only 13.3% was overweight while 60.7% were within the normal BMI range. About 39.7% had elevated blood pressure and the random blood sugar test indicated that 24% were hyperglycemic. There were significantly relationships between socioeconomic status and fatty meat: ($p<0.001$), fermented fresh whole milk ($p<0.001$), fermented millet drink ($p<0.001$) and cigarette smoking ($p<0.001$). **Conclusion:** There was a remarkable reduction in choice and consumption of food/nutrients by the outpatients which is very encouraging and will help the patients to manage their cardiovascular diseases conditions. **Recommendation:** Nutritionists/dietitians need to continue to enlighten patients that have been well managed before discharging them and they should ensure follow –up of those patients to see how their managing themselves at home in order to reduce the relapses that usually occur after being discharged from health facilities.

**Keywords:** Hospital, Cardiovascular, Diseases, Outpatients, Management, Nutritional

**ST3-5-016P: Agroecological Agriculture: A Key to Safe And Nutritious Food: Case Study of Lari Sub-County in Kiambu County, Central Kenya**

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This research project was undertaken in Lari Sub-County of Kiambu County in Central Kenya in 2017/2018 with support from Participatory Ecological Land Use Management (PELUM) Kenya and Institute for Culture and Ecology ICE Kenya. **Background** information revealed that Lari Sub-county is predominantly a tea-growing area with tea bushes covering over 70% of the land, about 10% under fodder crops and 20% under food crops. This predisposes the area residents to food insecurity due to inconsistency and unreliability in payment of tea bonuses to farmers. The area, despite being a cash-crop growing area, has poverty levels of around 40 %. Households’ survey revealed that over 50% of each household’s budget goes towards purchase of food. The **objective** of this study was to assess
the impact of agroecological farming practices in enhancing household food security and nutrition. The methodology applied was randomized block design where Kamburu Ward was picked. A sample of farmers and other key informants were picked and interviewed using semi-structured questionnaires. Focus group discussions (FGD) bringing together selected farmers, officers from Department of Agriculture and other local stakeholders were held. Triangulation of the three categories of respondents helped to validate the information collected from the respondents. Randomly picked households were visited to observe agroecological farming practices being employed as well as assess household food security and nutrition situation. These households were of two categories: those practicing agroecological farming and those not practicing. The results obtained indicated that the main agroecological farming practices observed in most of the households were organic farming and agroforestry. Households practicing agroecological agriculture were around 60% while the remaining 40% applied chemical inputs such as fertilizers and pesticides. The former incurred lower costs of production and had higher farm productivity and household incomes compared to the latter. The former also reported fewer cases of nutrition-related illnesses compared to the latter. In conclusion, agroecological agriculture contributes more significantly to household food security and improved nutrition and it should therefore be promoted especially in cash-crop growing areas.

**ST3-5-017S: Effects of lactic acid fermentation on functional properties of fruits and vegetables-A Review**

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Consumers’ awareness towards the association between food and health has flared up interest in “healthy foods” in recent years. They have increasingly believed that food contributes directly and effectively to health promotion. Therefore, objectives of food researchers are now to investigate new food products that promote health. It has been widely suggested that high intake of fruits and vegetables, nutrient-rich plants and antioxidant-rich beverages may reduce the risk of degenerative and oxidative-stress related diseases. However, post harvest losses hinder availability of these fruits and vegetables all year round due to their perishability, seasonality and low value addition. Nevertheless, food processing for extended shelf life such as drying can trigger undesirable chemical and physical changes especially vitamins and natural antioxidants which are rapidly degraded during thermal processing techniques leading to a decrease in antioxidant activity. Lactic acid fermentation is one of the oldest ways of food processing and preservation, liable to keep or increase the safety, nutritional (probiotic and biogenic effects), sensory and shelf-life properties of foods. This review seeks to explore the effects of lactic acid fermentation with selective probiotic cultures on fruits and vegetable processing with emphasis on functional properties retention and enhancement, challenges hindering utilization and possible interventions.

**ST3-5-018S: Development of a photographic food atlas to support food portion estimation among children and adolescents aged 9-14 years in Nairobi, Kenya**

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**Background:** Worldwide there has been significant changes in the nutritional status of children and adolescents due to economic development and urbanization specifically in low- and middle-income countries. There is scarcity of information on food intake of adolescents especially in the rapidly changing urban environments. Reliable measurement of food intake is dependent on accurate estimation of food portion sizes. Children’s ability to recall foods consumed can vary widely. The use of a photographic food atlas, with applicable portions for children, improves the ability to estimate portion sizes accurately. There was no such a photographic food atlas in Kenya.  

**Objective:** The aim of this study was to develop a photographic food atlas to support food portion estimation among Kenyan children and adolescents aged 9-14 years in Nairobi, to support a quantitative 7-day FFQ. The usability of the atlas was tested amongst adolescents and nutrition professionals.  

**Methodology:** Participants were recruited in two Nairobi City sub-counties Embakasi and Langata to represent low and middle-income socio-economic status respectively. Ten families with an adolescent aged 9 to 14 years from Embakasi and eleven from Langata participated in the weighing of portion sizes. Three portion sizes (A, B, C) were calculated for most of the 88 food items. Cooking demonstrations were arranged with the families of participants and the food portions were photographed.
A photographic food atlas was compiled, and its usability was tested amongst eight adolescents and four nutrition professionals. The usability survey consisted of Likert scale and open-end questions. **Results**: Overall the results for acceptability and usability were high amongst adolescents and professionals. Half of the adolescents disagreed, and one was unsure when asked if they could use the atlas on their own. Two adolescents disagreed and two were unsure if the smallest portion sizes were small enough. Professionals gave verbal suggestions on improvements, for example which foods were missing and in which order to present foods. **Conclusions**: Based on the feedback received, a second version of the atlas was created. More foods were included, and printing quality was improved. Future research is recommended to validate the photographic food atlas.

**Key words**: Adolescents, Children, Food atlas, Nairobi, Portion size

**ST3-5-021S: Nutrient Retention of Solar-Dried African Leafy Vegetables, Kiambu County, Kenya**

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**Background**: Micronutrient deficiencies still pose major health challenges in many African countries with certain population groups such as women of reproductive age being at a greater risk. Nutrition sensitive approaches, which include the use of local biodiversity, are currently being advocated in tackling nutrient deficiencies. African leafy vegetables form part of local agricultural biodiversity and have been part of the daily livelihoods of the local populations for many years. These vegetables hold promise in addressing micronutrient deficiencies if their supply and consumption are scaled up through the right application of appropriate postharvest technologies. **Objectives**: The purpose of this study was to determine the retention of iron, zinc, β-carotene and vitamin C; in pumpkin leaves (*Cucurbita maxima*), Fig-leaf gourd (*Cucurbita ficifolius*), and stinging nettle (*Urtica dioica*) subjected to various processing treatments including solar drying, blanching and cooking. **Methodology**: About 4kg of fresh vegetables were purchased from Kiambu market and appropriately packed and stored for processing and analysis. Iron and zinc were quantified using AAS while β-carotene and Vitamin C were quantified using HPLC. All determinations were carried out in triplicate and mean values computed.

**Results**: Pumpkin leaves had highest iron content of 29.331 ± 0.474 mg/100g dw, followed by Fig-leaf gourd at 25.38 ± 0.06 mg/100g dw. Zinc content was highest in figleaf gourd (5.51 ± 0.08mg/100g dw) and lowest in pumpkin leaves (3.907 ± 0.055mg/100g dw). Stinging nettle leaves had the highest pro-vitamin A (β-carotene) content of 34.69± 0.14 mg/100dw followed by pumpkin leaves. Vitamin C was highest in stinging nettle leaves 228.60±1.81mg/100g dw and lowest in pumpkin leaves (118.73 ± 0.15mg/100g dw). Both blanching and cooking had significant impact on the content of both minerals and vitamins in the leafy vegetables. Except for Vitamin C, solar drying did not engender significant changes in nutrient content of the vegetables. **Conclusion**: The study reveals that the three ALVs of the study are rich sources of key nutrients and solar drying is a viable means of processing that would extend their shelf life and ensure all year round availability.

**Key Words.** Nutrient retention, African Leafy Vegetables, Blanching, Solar drying

**ST3-5-024S: Nutrient Composition and Consumer Acceptability of Maize/Mushroom Composite Porridge for Complementary Feeding in Siaya County, Kenya.**

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**Background**: Undernutrition in childhood continues to haunt many parts of the world with developing countries particularly in Sub-Saharan Africa bearing the brunt. It is a leading contributor to child morbidity and mortality being culpable for half of global child mortalities. Food based approaches including appropriate processing technologies are part of nutrition sensitive interventions currently advocated for sustainable nutritional outcomes in various populations. Mushrooms, reported to be rich in nutrients, carry potential to complement cereal-based preparations for infant and young child feeding to enhance their nutritional adequacy. **Objective**: The objective of this study was formulate a nutritious complementary porridge flour based on maize and oyster mushrooms and assess its sensory acceptability. **Methods**: Validated procedures were used for nutrients analysis of the samples. All analytical determinations were carried out in triplicate and means computed. Sensory evaluation was conducted using Larmond’s reverse 9-point hedonic scale questionnaire on mothers with children 6-23 months old. **Results**: The results
show significant mean compositional differences (p<0.05) between composite flour porridge (80:20 maize to mushroom formulation) and control (plain maize flour) porridge, in favor of the former, for all the nutritional components (proteins, iron, zinc, thiamine, riboflavin, niacin and total folates) analyzed except carbohydrates, fats and energy value. Sensory analysis showed significant differences (p<0.05) in taste and aroma scores (in favor of control porridge) but not in colour and mouthfeel between the two porridge samples. There was no significant difference in overall acceptability (p = 0.082) between the two porridge samples. **Conclusion:** Supplementation of maize flour with oyster mushroom flour improves its nutritional value for use as a complementary food. With further research to improve taste and aroma impression, the incorporation of mushrooms in complementary flour formulations is thus recommended.

**Key words:** Complementary feeding, Undernutrition, sensory acceptability,

ST3-5-022P: Dietary and food safety practices, related nutrition knowledge and attitudes among school-children in Nairobi City County, Kenya

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**Background:** Food consumption away from home and widespread food purchasing opportunities available to school-children encourages consumption of unhealthy and unsafe food. Urbanization and unsupervised eating exposes school-children to unhealthy and unsafe food. Further, most chronic illnesses in adulthood begin from dietary practices essentially framed early in life. Children’s related knowledge and attitude is therefore worth investigating. **Objective:** To determine the dietary practices and food safety gaps, related knowledge and attitude among school-children in an urban setting, Nairobi City County, Kenya. **Methods:** This was part of a larger International Atomic energy Agency (IAEA) Regional project RAF6042. A cross sectional survey was conducted among 202 school children aged 8-11 years purposively sampled. A structured questionnaire was used to collect data. Epi-data and SPSS computer packages were used for data management and analysis. Pearson’s Chi-square test was used to establish significant differences between variables at p<0.05. **Results:** Children’s age distribution was between 8-11 years with majority (40.6%) aged 11 and a mean age of 10.1±0.9 years with no significant differences between boys and girls (p<0.05). At home, 32.2% of them consumed their meals unsupervised. Overall children’s mean dietary diversity score was low, at 3.8±1.4. A 7-day food consumption frequency showed a pattern of cereals (83.7%), vegetables (82.2%) roots/tubers (77.7%) while only 6.4% and 9.9% consumed meat and fruits, respectively for more than 4 times in 7 days. Nearly all of them (95.5%) carried money to school daily to buy mid-morning snacks and/or lunch. About half (40.6%) had bought and consumed fast foods (French fries, cakes, doughnuts, crisps, smokies, biscuits etc) above 4 times in 7 days. Half of them (49.9%) had moderate nutrition knowledge but not in food safety. The children did not care much about food safety or what they ate (35.1%). Food and nutrition knowledge had no significant relationship with frequency and type of snacks consumed by the children (p>0.05). **Conclusion:** Knowledge gaps in this study show the need and urgency to address food safety gaps among other health aspects.

**Key words:** School children, Food consumption, Food safety, Knowledge, Attitude

ST3-5-026S: Achieving Environmentally Sustainable Food Security through Hotels’ Application of the 5Rs in Food Waste Management, Within Bauchi State, Nigeria

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**Background:** The Hospitality industry depend to a large extent on the environment for food materials. It records high volume of food wastage and also releases food waste unto the environment. Food waste and wastage are not only a threat to the environment but also to food security. Problems of food waste and wastage can be addressed through the adoption of the 5Rs which are Food Resource efficiency, food waste Reduce, Reuse, Recycle and Recovery. **Objective:** To find out the extent to which the different classes of hotels in Bauchi State have adopted the 5Rs. The study was guided by the Resource-Based View theory. **Methodology:** Study used cross-sectional descriptive survey design. Study population was all 49 classified hotels in Bauchi State from where 245 respondents were drawn. Purposive sampling was used to select 158 sample frame of managers and departmental heads from the available 42 hotels. A 5-point Likart scaled questionnaire for departmental heads and interview schedule for managers were used to collect data. Analysis of Variance (ANOVA) was used to determine differences in the level of adoption of the 5Rs among the different classes of hotels. **Findings:**
Result shows that generally, hotels in Bauchi State have adopted the 5Rs only to a small extent with a general mean of 2.45 and Standard deviation of 0.77. Result also revealed that hotels have mostly adopted the food waste reduce method being to a large extent (Mean=4.04), followed by food resource efficiency to a moderate extent (Mean=3.08). Food waste reuse to a small extent (Mean=2.19) while food waste recycle (Mean=1.96) and energy recovery from food waste has not been adopted at all (Mean=1.00). The study also found out that there are no significant differences (p=0.175) in the extent to which the different classes of hotels in Bauchi State have adopted the 5Rs and that the extent of adoption is not dependent on the class of hotel. **Recommendation:** Awareness creation among hotels’ operators on the need for the adoption of the 5Rs as means of ensuring environmentally sustainable food security.

**Keywords:** Environmentally sustainable, Food security, Hotels, 5Rs, Food waste management, Bauchi State

**ST3-5-027P: Effects of Declining Wood Fuel on Household Cooking Patterns and Nutrition Security in Tigania West, Kenya**

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Research on rural energy has in the past focussed on its access and environmental effects. Little is however documented on the relationship between declining availability of wood fuel, household cooking patterns and nutritional status. A 2016-2017 survey study in Tigania West, targeting 234 respondents showed that to about 81% of the households respond to energy shortages by cooking combined meals instead of single meals mostly twice per day. Further cooking food that took less time is preferred its low nutritional status notwithstanding. Consequently the nutritional status of under-5 years old and the elderly is consistently undermined. Traditional food that takes long to cook is soaked to reduce its energy demand. Since financial poverty limits access to electricity, steady supply of wood fuel remains a felt need, which can be enhanced through planting early maturing tree varieties with inherent ability to regenerate and sprout when harvested. While combined cooking saves energy and time, the negative health impact of skipping meals can be lessened by ensuring that the one or two meals per day are balanced diets. Ultimately lasting solutions to declining wood fuel and hence healthy cooking and feeding lies in adoption of energy efficient cook stoves and value addition on available energy options. Expanding income generation options at household levels will also make access to clean energy more possible.

**Key words:** Firewood, Cooking Patterns, Nutrition, Environment, Meru
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