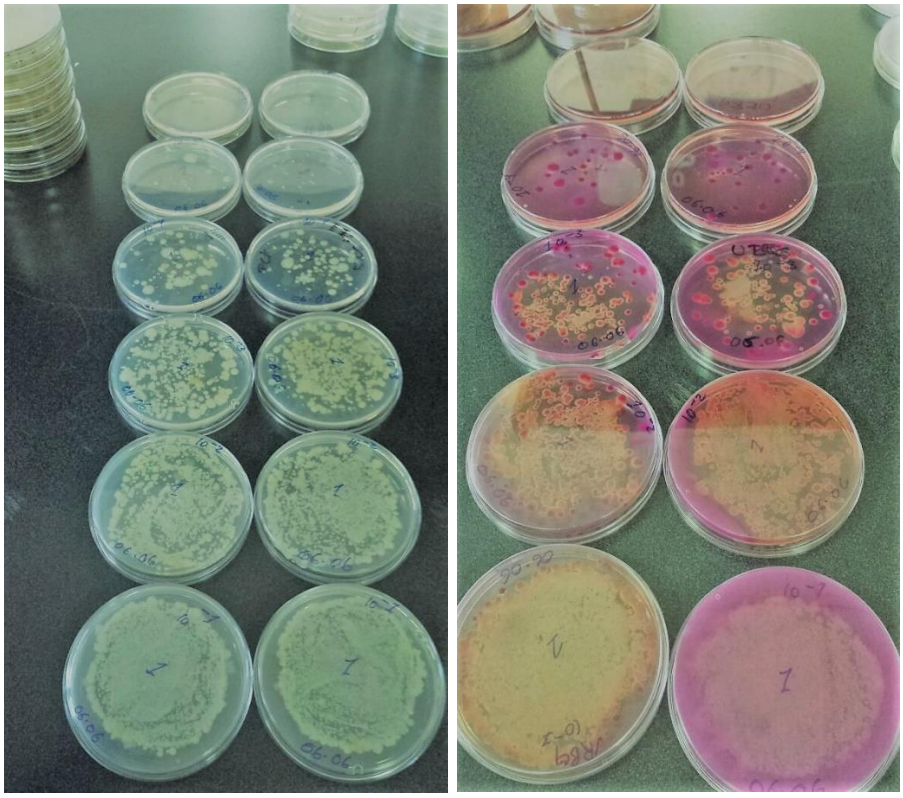
International Livestock Research Institute

Training course report

MoreMilk project: Laboratory training on milk hygiene and safety



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Project background

The MoreMilk project aims to generate research evidence on how informal milk markets can be leveraged to improve nutrition and health, especially in peri-urban settings. The overall objective of the project is to improve child health and nutrition outcomes through milk consumption. The project will evaluate the potential of milk markets and dairy development interventions to contribute to health and nutrition outcomes by

- assessing how markets and policies influence the quantity and safety of milk consumed in Nairobi, Kenya and Dar es Salaam, Tanzania;
- assessing the health and nutrition benefits of a successfully piloted informal dairy sector intervention (a trader training, certification and marketing scheme), through a randomized control trial in Nairobi;
- assessing the potential reach of the dairy trader training and certification intervention, as well as bridges and barriers to scale and sustainability through surveys in India, Kenya and Tanzania;
- assessing the drivers of milk consumption in dairy farming households in rural Kenya and Tanzania and developing a social behaviour change communication strategy for milk consumption; and
- scoping priority areas for food safety investments with a focus on Burkina Faso, Ethiopia and Nigeria.

The project will integrate a gender lens across these components. It will focus on understanding the ways in which women's empowerment can be leveraged to enhance milk quality and household nutrition.

The MoreMilk project is implemented by the International Livestock Research Institute (ILRI), the International Food Policy Research Institute, the International Institute for Environment and Development, and Emory University and is supported by the Bill & Melinda Gates Foundation and the United Kingdom Department for International Development.

Training summary

Organizers
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Martin Wainaina, ILRI, Kenya

Lecturers/facilitators
Herlinde Irsigler, Freie Universität Berlin, Germany
Kristina Roesel, ILRI, Kenya

Microbiological assessment is a cornerstone for understanding the safety of food that is produced, marketed and consumed. As part of the activities of the MoreMilk project, a baseline survey was conducted to assess the hygiene, nutritional quality and safety of milk consumed in 200 households in peri-urban Nairobi.

To facilitate the laboratory activities related to this objective, a training course on laboratory procedures for bacterial culture and identification was held from 29 May to 10 June 2017 to train one technician and four students on the relevant laboratory methods. The trainees have subsequently analysed milk samples from the survey for microbiological quality indicators and identification of common milk-borne hazards.

At the end of the training course, the participants were able to independently assess the general hygiene of milk samples (mesophilic total cell count and Enterobacteriaceae) and isolate *Staphylococcus* spp., *Salmonella* spp. and *Listeria monocytogenes* from milk samples.

The objective was not to carry out a comprehensive training on microbiology but to focus on selected techniques to identify bacteria in milk samples by morphology and culture. Other aspects for classification of bacteria (e.g. biochemistry, staining and molecular analysis) were not part of the curriculum.

Agenda

The training was mostly hands-on at the laboratory bench and therefore the agenda was not rigidly divided into lectures and laboratory sessions. We started with an introductory and orientation session that also included a safety induction and continued with a day of preparing media needed for the training. Instead of buying ready-to-use agar plates, it was part of the training to learn and understand how to prepare media, with special regards to the local working conditions. We then went through the method talks and workflows for each test protocol before demonstrating them in the laboratory and had the trainees practise these themselves. Specific topics such as confirmatory testing were covered in small seminars during waiting times (e.g. during test incubation or autoclaving).

Training material

All method talks, workflows based on the ISO protocols and additional information were distributed to the trainees in hard copy at the end of the training.

Topic	Training material
Introduction	Introduction of the project, participants, course schedule
	Objectives of the training, definitions, good scientific practices
	Pre- and post-training assessment
	Laboratory safety induction
Media preparation	Recipes for all media used during the course
Detection and enumeration of total mesophilic bacteria	Method talk I
	Workflow based on ISO 4833-2:2013
	Handout on how to prepare a decimal solution
Detection and enumeration of Enterobacteriaceae	Method talk II
	Workflow based on ISO 21528-2:2004
	Handouts on oxidase test and oxidative/fermentative test
Detection and enumeration of coagulase-positive staphylococci (including *Staphylococcus aureus*)	Method talk III
	Workflow based on ISO 6888-1
	Handout on catalase test
Detection of *Salmonella* spp.	Method talk IV
	Workflow based on ISO 6579:2002
Detection of *Listeria monocytogenes*	Method talk V
	Workflow based on ISO 11290-1:1990
	Handout on CAMP test
Additional materials	Handout on streaking agar plates (loop technique) Data record sheet templates Quality assurance: incubator temperature monitoring sheets Kenya government standards for raw cow milk (KS EAS 67:2007)

Photographs (including those of examples of prepared agar plates), results of the training assessments and specific updates were shared by email after the training. Remote guidance by email was given to the MoreMilk project laboratory technician and students who continued analysing the milk samples after the training ended.

Training assessment

The questions below were asked on the first day of the training and again on the last day. Each question was allocated a score depending on its level of difficulty (1 being the least difficult and 3 the most difficult). The group score was obtained by adding the adding up the individual scores obtained by each of the five trainees who took the test before and after the training. Overall, there was a growth in scores achieved, with particular increase of knowledge in questions relating to specific test protocols and principles.

Question	Score	Total achievable group score*	Pre-training	Post-training
1	2	10	4.5 (45%)	7 (70%)
2	1	5	5 (100%)	4 (80%)
3	2	10	3 (30%)	6 (60%)
4	3	15	2.5 (17%)	7 (47%)
5	2	10	2 (20%)	4 (40%)
6	3	15	1 (7%)	5.5 (37%)
7	2	10	4 (40%)	6.5 (65%)
8	3	15	2 (13%)	11.5 (77%)
9	1	5	5 (100%)	5 (100%)
10	3	15	10 (67%)	14 (93%)
11	2	10	3 (30%)	2 (20%)
	24	**120**	**42 (35%)**	**72.5 (60%)**

1. Why is raw milk tested in the laboratory? Which general characteristics are usually tested? (score 2)
2. Which milk-borne human pathogens do you know? Please list at least three. (score 1)
3. Explain the differences between a method meant for counting of bacteria and pathogen detection, and give an example of each. (score 2)
4. What is the principle of the tube coagulase test and for which bacteria is it used? Please explain. (score 3)
5. Please explain the principle of the oxidase test. Please name one oxidase-negative and one oxidase-positive bacterium. (score 2)
6. For which purposes/questions would you apply the CAMP test? Please explain and describe the principle of the test. (score 3)
7. At which temperatures would you incubate a Baird-Parker agar plate for the detection of staphylococci compared to a Violet Red-Bile-Glucose agar for the detection of Enterobacteriaceae and why? (score 2)
8. Briefly summarize the workflow for the isolation of *Salmonella* spp. from milk. (score 3)
9. Why do we sterilize growth media prior to use? (score 1)
10. Give three arguments why we work according to standard operating procedures. (score 3)
11. Are you allowed to modify standard operating procedures? Please explain. (score 2)

Acknowledgements

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List of participants

Serial No.	Name	Email contact	Sex (M/F)	Country of origin	Country classification (LMIC/HIC)
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