Milk production practices, udder health and the impact on milk quality, safety and processability in Rwanda

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RESEARCH TEAM

• Rwanda
  - Jean Baptiste NDAHETUYE (PhD candidate UR-CAVM/SLU): PI
  - Juvenal Djangwani, Msc. Assistant Lecturer UR-CAVM (Co-PI)
  - Anselme Shyaka, DVM, PhD, Head of Veterinary Department at UR-CAVM (Co-PI)

• Sweden
  - Renée Båge, Associate Professor (SLU) (Co-PI)
  - Karin Artursson, Professor, and Director of Research National Veterinary Institute (SVA) (Co-PI)
  - Ylva Persson, PhD, Associate, State Veterinarian, (SVA) (Co-PI)
  - Ann Nyman, PhD, Researcher, Epidemiologist, (SVA) (Co-PI)
PROJECT OBJECTIVES

• To evaluate udder health, milk quality, safety and suitability for processing in four milk shed in Rwanda

• To train best practices for good udder health and milk quality:
  • Dairy farmers, milk middlemen and paraveterinarians
  • Milk Collection Centers (MCC) managers/technicians, sector extensionists/veterinarians and students.
1. TO EVALUATE UDDER HEALTH, MILK QUALITY, SAFETY AND SUITABILITY FOR PROCESSING IN FOUR MILK SHED IN RWANDA
RELEVANCE OF MASTITIS FOR THE DAIRY INDUSTRY

- Inflammation of mammary gland: Clinical or subclinical mastitis (SCM)
- Mastitis is caused by a range of microorganisms and is multifactorial (Animal, Environmental and management factors)
- Decreased milk yield
  9-45% drop in milk production per infected quarter
- Reduced milk quality
- Other sources of losses: Veterinary service, Drug, Extra labor, Early culling, discarded milk
- Risk for development of antimicrobial resistance

Greatest economic losses (70% of the total losses, reduced quality leads to rejections)
IMPACT OF MASTITIS ON MILK YIELD AND QUALITY

• Measurement of Somatic cell counts (SCC) is gold standard method for diagnosis of mastitis (SCC increases in milk at an infection which is reflected by an inflammation)

• Direct measurement of SCC: bulk milk, Objective, improve decision making

• Indirect with California mastitis test (CMT): Cow-side and may be subjective

• **Mastitis causes**: Reduced milk yield, change in milk composition, reduced cheese yield, reduced quality of milk products
1. BASELINE DATA COLLECTION ON MASTITIS, MILK QUALITY AND SAFETY

Bulk milk, MCC (8/2 in each region)
- SCC (Direct method) + microbiological quality analyses

Bulk milk, farm
- SCC (Direct method) + microbiological quality analyses

Cow, quarter milk
- CMT + Bacteriological analyses + questionnaire
EVALUATE UDDER HEALTH:
PREVALENCE OF SUBCLINICAL MASTITIS (SCM)

<table>
<thead>
<tr>
<th>Region</th>
<th>MCC</th>
<th>Total no. cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>1 (Duphaco)</td>
<td>73</td>
</tr>
<tr>
<td>East</td>
<td>2 (Nyagatare)</td>
<td>75</td>
</tr>
<tr>
<td>North</td>
<td>3 (Nyankenke)</td>
<td>71</td>
</tr>
<tr>
<td>North</td>
<td>4 (Gatuna)</td>
<td>66</td>
</tr>
<tr>
<td>West</td>
<td>5 (Mudende)</td>
<td>71</td>
</tr>
<tr>
<td>West</td>
<td>6 (Rubengera)</td>
<td>72</td>
</tr>
<tr>
<td>South</td>
<td>7 (Muyira)</td>
<td>75</td>
</tr>
<tr>
<td>South</td>
<td>8 (Rugobagoba)</td>
<td>74</td>
</tr>
<tr>
<td><strong>Rwanda</strong></td>
<td></td>
<td><strong>577</strong></td>
</tr>
</tbody>
</table>

Fig 1: Prevalence of SCM % in selected regions
Bulk milk SCC at farm level in Nyankenke MCC

SCC x 10^3/ML vs. Farm sampled
BULK SCC OF BULK MILK AT MCC LEVEL

Dry season 2017
Rain season 2017
Short dry season 2018
Rain season 2018
**Bacterial species in SCM cases in Rwanda**

- **Contagious microorganisms**
- **Environmental microorganisms**

<table>
<thead>
<tr>
<th>Bacterial Species</th>
<th>Relative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudomonas fluorescens</td>
<td>6.7%</td>
</tr>
<tr>
<td>Enterococcus raffinosus</td>
<td>1.9%</td>
</tr>
<tr>
<td>Staphylococcus equorum</td>
<td>0.6%</td>
</tr>
<tr>
<td>Staphylococcus pasteuri</td>
<td>0.6%</td>
</tr>
<tr>
<td>Staphylococcus scurie</td>
<td>0.6%</td>
</tr>
<tr>
<td>Enterococcus durans</td>
<td>0.3%</td>
</tr>
<tr>
<td>Enterococcus casseliflavus</td>
<td>0.3%</td>
</tr>
<tr>
<td>Streptococcus uberis</td>
<td>0.3%</td>
</tr>
<tr>
<td>Lactococcus raffinolactis</td>
<td>0.3%</td>
</tr>
<tr>
<td>Lactococcus garvieae</td>
<td>0.3%</td>
</tr>
<tr>
<td>Staphylococcus hyicus</td>
<td>0.3%</td>
</tr>
<tr>
<td>Enterococcus faecalis</td>
<td>0.3%</td>
</tr>
<tr>
<td>Staphylococcus haemolyticus</td>
<td>0.3%</td>
</tr>
<tr>
<td>Staphylococcus xylosus</td>
<td>0.3%</td>
</tr>
<tr>
<td>Lactococcus lactis</td>
<td>0.3%</td>
</tr>
<tr>
<td>Staphylococcus epidermidis</td>
<td>0.3%</td>
</tr>
<tr>
<td>Staphylococcus chromogenes</td>
<td>0.3%</td>
</tr>
<tr>
<td><strong>Staphylococcus aureus</strong></td>
<td>63.6%</td>
</tr>
</tbody>
</table>

- **63.6% beta-lactamase positive** = penicillin resistant
- **N=327**
Factors associated with increased odd ratio of SCM were:

- Increasing stage of lactation
- Poor udder and legs hygiene
- No calf suckling the dam
- Not offering supplemental feeds to cows
TBC: MCC level Vs respective farm level

- DUFACO/Rwamagana
- Nyagatare
- Nyankenke
- Gatuna/Blessed Daries
- Mudende
- Rubengera
- Muyira
- Rugobagish

Coliforms: MCC level Vs respective farm level

- DUFACO/Rwamagana
- Nyagatare
- Nyankenke
- Gatuna/Blessed Daries
- Mudende
- Rubengera
- Muyira
- Rugobagish

TBC (CFU/ml) at MCC

- TBC (CFU/ml) mean at farm level

Coliforms (CFU/ml) at MCC

- Coliforms (CFU/ml) mean at farm level
MILK QUALITY AT FARM AND MCC LEVELS

• Generally: TBC increased from farms to respective MCC suggesting multiplication and/or additional contamination during transport

• The highest MCC TBC counts (MCC 3,7 & 8) correspond to MCCs where milk transporters to MCC are at least 87.5% middlemen

• Coliforms presence at farm and MCC calls for stringent hygiene protocol at both points

• Low levels of antimicrobial residues in milk (5 out of 408 on bulk milk from farm level, total absence at MCC level)
IMPLICATIONS OF RESEARCH FINDINGS ON MASTITIS PREVENTION AND CONTROL IN RWANDA

- Preventing and control mastitis will lead to increase in milk yield
- Contagious bacteria in mastitis cases implies spread from cow to cow during hand milking – decision making for optimal preventive routines
- High prevalence of penicillin resistance among prevalent udder pathogens may lead to treatment failure
- Few herds may contribute to high cell count of milk at MCC level, for successful mastitis control such herds must be identified
- Possible to produce milk with low SCC = good udder health
TO TRAIN BEST PRACTICES FOR GOOD UDDER HEALTH AND POST HARVEST HANDLING OF MILK:

• Target trainees: farmers, model farmers, milk middlemen, Para-veterinarians and opinion leaders in the communities

• Mastitis prevention and control and proper milking routine

• Cow shed management

• Post harvest milk handling and milk safety
TRAINING OF THE TRAINERS

- Mastitis etiology, diagnosis and effects on milk quality
- Preventive udder health and treatment strategies (Dr. Ylva Persson)
- Post-harvest handling of milk and milk quality testing
- Dairy herd reproduction management and milk productivity (Ass. Prof Renee Bage)
INTRODUCTION TO DAIRY ASSESSMENT AND ADVISORY TOOL

- Qualitative tool to monitor best practices to prevent and control mastitis, enhance milk quality and productivity
- Components to monitor includes:
  - Hygiene of housing, milking routine, milk handling, mastitis, cow management etc.
  - Each component is further divided into different element and are assessed on scale as to provide farmers their performance (serve as feedbacks to improve their practices), i.e.:

```
NUTRITION  | RECORD KEEPING | COW MANAGEMENT |
MASTITIS   | MILK HANDLING  | MILKING ROUTINE |
            | HOUSING        |                |
```

0%  20%  40%  60%  80%  100%
### 4. Mastitis

<table>
<thead>
<tr>
<th>ASSESSMENT</th>
<th>SCORE (1-5)</th>
<th>SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.1 Control of contagious mastitis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Cows with contagious mastitis are milked last or in a separate milking place used for the infected cows.</td>
<td>2</td>
<td>1 – No; 3 – Contagious cows milked last; 5 – Contagious cows milked separately</td>
</tr>
<tr>
<td>2 Milk from infected quarters is discarded</td>
<td>2</td>
<td>1 – No; 3 - Kept separately and fed to calves; 5 – Yes</td>
</tr>
<tr>
<td>3 Teats are dipped in germicide after each milking</td>
<td>2</td>
<td>1 – No; 5 – Yes</td>
</tr>
<tr>
<td>4 Separate cup for infected cows/quarters</td>
<td>5</td>
<td>1 – No; 5 – Yes</td>
</tr>
<tr>
<td>5 Individual cloth/paper towels are used to wash/dry teats.</td>
<td>2</td>
<td>1 - Not washed; 2 - Washed, not dried; 3 - Dried with reusable cloth; 4 - Dried with other dispensable material (newspaper,etc); 5 - Dried with individual cloth or paper towel</td>
</tr>
<tr>
<td><strong>4.2 Control of environmental mastitis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Teats are pre-dipped with germicide before milking</td>
<td>5</td>
<td>1 – No; 5 – Yes</td>
</tr>
<tr>
<td>2 Cows should be kept standing after milking (offer them feed)</td>
<td>1</td>
<td>1 – No; 5 – Yes</td>
</tr>
<tr>
<td>3 Practices to reduce stress are employed (proper handling, hoof care, climate season) considerations)</td>
<td>1</td>
<td>1 – No; 5 – Yes</td>
</tr>
<tr>
<td><strong>4.3 Diagnosing mastitis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is CMT testing conducted on the farm?</td>
<td>2</td>
<td>1 - No; 2 - Once every 6 months; 3 - Once every 3 months 4 - Once every month; 5 - Once every 2 weeks</td>
</tr>
<tr>
<td><strong>4.4 Treating sub-clinical mastitis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In case of subclinical mastitis, dry cow antibiotics are administered directly after the last milking before drying off. All four quarters treated</td>
<td>3</td>
<td>1 – No; 2 – Antibiotics are not applied aseptically, 3 – Only obviously affected quarters are treated, 4 – All four quarters treated aseptically</td>
</tr>
<tr>
<td><strong>4.5 Treating clinical mastitis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antibiotic treatment: cow is milked out and then given an intramammary infusion of antibiotic. Infused directly into the infected gland.</td>
<td>3</td>
<td>1 – Not treated; 2 – Antibiotic is not administered directly into affected quarter; 3 – Administered incorrectly but treatment length is respected; 4 – Administered adequately but treatment length is not respected; 5 - Administered adequately and treatment length is respected</td>
</tr>
<tr>
<td>2 Only acute (sudden onset) cases are treated with antibiotics.</td>
<td>1</td>
<td>1 – No animals treated; 2 - Only chronic cases are treated with antibiotics; 3 - Both acute and chronic are treated; 4 - Chronic cases are administered supportive treatment or culled if no longer economically viable; 5 - Dry cow therapy for chronic cases</td>
</tr>
<tr>
<td>3 Dry cow therapy for chronic cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Withdrawal period is checked and maintained for cows under treatment</td>
<td>1</td>
<td>1 – No; 3 - Kept separately and fed to calves; 5 – Yes</td>
</tr>
</tbody>
</table>
RECOMMENDATIONS

• Adapt and disseminate the 10 point-mastitis control plan

• Incorporate SCC in MCC evaluation, whenever SCC of any MCC rises above standard limit (3 \( \times \) \( 10^5 \) cells/ml RSB, or 4 \( \times \) \( 10^5 \) cells/ml) limit, initiate interventions (screening cows, training etc.) at farm level

• Develop farm Standard Operating Procedures and use of dairy assessment and advisory tool to monitor, benchmark and provide feedbacks on dairy best practices for farmers

• Continual refresher training at both basic (farmers) and advance level (technicians, veterinarians) on mastitis control
ACKNOWLEDGEMENT

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• Milk Collection Centers
• Farmers
Murakoze Cyane = Thank You Very Much
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