

# Milk quality improvement through training and interventions: Experience sharing from NWO ARF project

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## **Abstract**

In the NWO ARF project: Healthy Cows – Healthy Food – Healthy Environment: Enhancing safety and quality of milk in Ethiopia one pillar was to improve milk quality by training the laboratory personnel of the VDFACA laboratory (Addis Ababa, Ethiopia) in milk quality testing techniques. This training included somatic cell count, antibiotic screening and screening for aflatoxins. The training took place in Wageningen at RIKILT (now Wageningen Food Safety Research) between October 28 - November 3, 2018. The training was very successful and the laboratory personnel proved to be able to do sampling and analysing milk in Ethiopia. In the healthy cow project, after an initial inventory of the main problems in cow and calf health, interventions were done consisting of training in cow and calf management. With help of our Indian experts, prof. Punniamurthy and prof. Nair, farmers learned how to treat their animals with herbal medicine, most of those used as kitchen spices or herbs growing in the neighbourhood.

In a later phase milk samples from the farmers included in project were compared with reference samples from comparable farmers. In most parameters the milk of the project farmers scored better than the reference farmers. The use of the interventions resulted in better milk quality concerning fat, protein, lactose, number of pathogenic bacteria and levels of some antibiotic residues. At field level the trial has performed very well, which has inspired farmers within and outside the project and has drawn the attention of consumers, policy makers and other dairy projects for further upscaling. The use of herbs is not only gaining interest in Ethiopia, also in the Netherlands the government is actively promoting the use of natural products including herbs to reduce the use of antibiotics. The Dutch approach consists of a combination of strict monitoring of the use of antibiotics, the implementation of strategic sampling techniques and the use of herbs to keep the animals healthy.

## **Introduction to the project**

The project “Healthy Cows – Healthy Food – Healthy Environment: Enhancing safety and quality of milk in Ethiopia with a focus on antibiotic residues” aimed at enhancing milk quality and the position of women in dairy farming pilot town of Ethiopia. It was an NWO applied Research fund project headed by ESAP (dr. Getachew Gebru and dr. Daniel Temesgen) together with Dutch Farm Experience (dr. Katrien van’t Hooft) and Wageningen Food Safety Research (dr. Maria Groot and dr. Mariel Pikkemaat). The project was implemented from October 2017 until the end of December 2020.

The project aimed to implement and embed the best practices worldwide for producing healthy milk in Ethiopia. Using Ethiopian experience of small holder dairy farmers, Indian knowledge of medicinal herbs for reduction of the use of antibiotic to capitalize Ethiopian ethnoveterinary knowledge, Dutch knowledge of cow management and milk quality control. In the project we aimed to educate women to tend herbal gardens to make herbal remedies for extra income and used training of trainers in

residue analysis from the Netherlands to support the Veterinary Drug and Feed Administration and Control Authority (VDFACA) quality control laboratory for milk quality and residue analysis.

### **Objectives**

This was a collaboration project towards a system change in dairy farming in Ethiopia, in which the dominant focus on increasing milk quantity for the growing population is strategically combined with improving milk quality – and involving women in tending animals health by using herbal remedies and good dairy farm management practices. The overall goal of this proposal therefore is:

To enhance safety and quality of milk in Ethiopia through applied research & capacity building at four levels:

- Empowering of women to get income out of herbal gardens selling herbs to improve animal health leading to production of residue-free milk,
- Training of trainers for milk quality control,
- Establishing baseline data on residues and
- Raising awareness on antimicrobial resistance (AMR)

The project aimed to stimulate innovation by: (1) piloting the Centre of Expertise for Natural Livestock Farming (NLF) 5 layer strategy to produce milk without chemical residues and (2) strengthening the capacity for milk quality control (3) empowering women to grow and process herbs for remedies to heal cattle and reduce the use of antibiotics.

### **Training**

In the brand-new VDFACA quality control laboratory building highly motivated staff and hi-tech analytical equipment are available. But there was a lack of experience with routine sampling, testing of milk microbiology (TMC & SCC) and antibiotic residues. The project included a training of six laboratory staff analysts from VDFACA quality control laboratory and one from Ethiopian Agriculture Research Institute (EARI) in microbiology and antibiotic residue analysis at RIKILT-Wageningen University and Research (now Wageningen Food Safety Research) in the Netherlands from 29 October – 3 November 2018, for training on milk quality and safety.

Focus of the training was primarily on:

- Total bacterial count (TMC) – according to ISO 4833
- Somatic cell count (SCC) – according to ISO 13366
- Identification of selected pathogen bacteria (Salmonella, E.coli & Staph. aureus)-conventional method
- Assessment of antimicrobial resistance (AMR) profiles of the identified pathogen bacteria- using antibiotic disc diffusion techniques
- Antibiotic residues – using Trisensor and Delvotest with lateral flow

Next to the training, laboratory supplies were purchased and sent to Ethiopia in two rounds and be able to perform the required analysis. This was a lengthy process and it took almost a year to ship all supplies to Ethiopia.

### **Results of the project**

First step was establishing baseline data and make an inventory of the problems the farmers encountered. Training by Indian experts (prof. Nair and prof. Punniamurthy) of farmers helped them to treat the animals for common diseases and so keep the animals healthy and reduce the use of antibiotics. Growing medicinal herbs for extra income for women was used to reduce the use of antibiotics. Training of farmers in cow and calf management helped the farmers to keep the animals

healthy. Improving milk quality was done through education (training of trainers) and implementing of appropriate milk quality testing techniques combined with data gathering in field.

### **Milk quality improvement**

In the course of dairy development until now, the main focus has been on productivity and milk quantity. At this point in time, the crisis with AMR obliges the sector to look beyond this and focus on both milk quantity and milk quality. The VDFACA quality control laboratory took many samples of milk from the farmers which joint the project. First samples were taken to establish the baseline situation; later samples were aimed to assess the changes in quality due to the interventions of the project. Sampling started in December 2019. The VDFACA laboratory proved able to do the sampling, identify the pathogens, perform somatic cell count, antibiotic residues testing and a range of milk quality parameters.

Comparison project farmers data on pathogens with reference data.

Table 1. Comparison NWT-ARF milk data on pathogen bacteria isolation test results

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	n	E.Coli	Salmonella	Staph Aureus
NWO/ARF	60	11,67 %	1, 67 %	46,67 %
Reference data	59	25,42 %	1, 69 %	67,80 %

Table 1 shows the reduction in the presence of E. Coli with more than 50 % and Staph aureus by 30 %. The laboratory could identify antibiotic residues form beta-lactam antibiotics, sulfa's and tetracyclins. In the milk samples beta-lactam antibiotics were mostly found.

Table 2 below, shows milk quality data of the project samples compared with reference samples. In most aspects (fat, protein, lactose, solid non-fat and density) the project samples scored better than the reference samples from comparable dairy farmers.

**Table 2. Comparison of NWO-ARF milk quality data with reference samples**

	NWO ARF				Control samples			
	maximum	Minimum	Average	Within limit	maximum	Minimum	Average	Within limit
Fat min. 3,5 %	7.18	0.94	2.91	16/60	6.60	0.2	2.74	13/59
Solid not fat min. 8,5 %	10.43	6.80	8.92	47/60	10.73	2.38	7.86	25/60
Protein min. 3,2 %	4.02	2.48	3.31	40/60	3.97	0.79	2.89	22/60
Lactose min. 4,2 %	5.88	3.64	4.86	56/60	5.81	1.17	4.24	19/60
Density at 15.6 25°C.  1.026-1.032	1.034	1.020	1.027	41/60	1.0312	1.0063	1.0232	33/60
Freezing point  -0.550 to -0.525	-0.264	-0.614	-0.046	8/60	-0.304	-0.558	0.449	6/60
Minerals  0.7-0.9 %	1.2	0.0	0.6	40/60	0.9	0.32	0.65	27/60

In this process it is important to acknowledge the importance of the lessons learnt over the past decades, in both smallholder and large scale dairy farming. Dairy development professionals tend to look at the Netherlands for dairy sector innovation. Meanwhile, the success of the smallholder dairy sector in India, both in terms of milk quantity and quality can be another important inspiration for sustainable dairy development in SSA countries.

To monitor the effects of interventions and the quality of the milk it is of utmost importance to have a solid milk quality testing system with capable staff and good laboratory supplies. We trust that this project had a role in establishing the required capacity and therefore, amplification of the demonstrated success to a nationwide dairy farm management practice is recommended.

*Key words: anti-microbial resistance (AMR), milk quality*