TRAINING & WORKSHOP

PREVENTION AND SUSTAINABILITY IN THE INDIAN DAIRY SECTOR

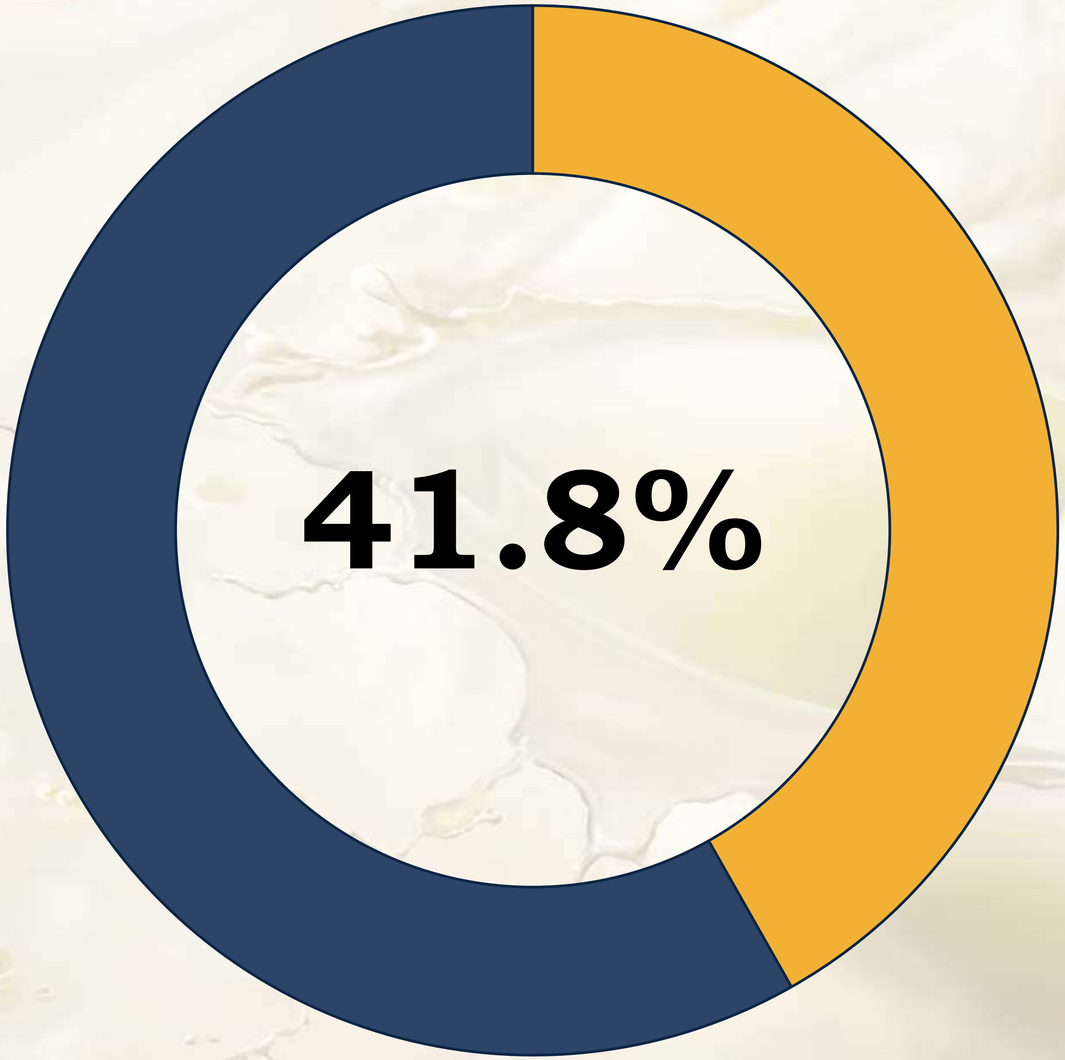
FOR PRODUCTIVITY, LIVELIHOOD GENERATION AND CLIMATE RESILIENCE



NDDB's Approach to Disease Management in Indian Dairy Sector

Dr A V Harikumar
Group Head (Animal Health)
National Dairy Development Board, Anand

Increasing AMR…



of isolates from mastitis milk samples were multidrug-resistant (MDR)

Nearly 1 in 2 mastitis pathogens resists multiple antibiotic classes!

Increasing pyrethroid resistance..

State	Tick pools genotyped	Domain II (C190A)	Domain III (T2134A)
Karnataka	14	**RR 92.9% · SS 7.1%**	**SS 100% (14/14)**
Gujarat–1	9	**RR 100% (9/9)**	**SS 100% (9/9)**
Gujarat–2	4 of 8	**RR 100% (4/4)**	**SS 100% (4/4)**
Maharashtra	4 of 8	**RR 100% (4/4)**	**SS 100% (4/4)**
Assam–1	1	**RS 100% (1/1)**	**SS 100% (1/1)**
Assam–2	1	**SS 100% (1/1)**	**SS 100% (1/1)**

RR resistant RS heterozygous SS susceptible

Note: Even if one Domain remains susceptible, the ticks will still be highly resistance to synthetic pyrethroids

ONE HEALTH GAP

Brucellosis awareness among medical professionals in a district

72

Medical doctors surveyed

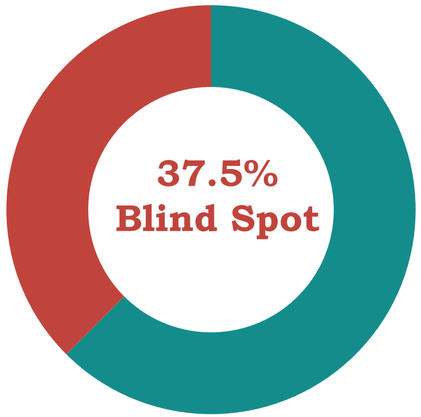
62.5% (45)

Are aware of brucellosis

37.5% (27)

Have NEVER heard of brucellosis

Awareness level proportion



1 **Alarmingly high diagnostic blind spot**

Over 1 in 3 doctors have never heard of brucellosis — in an endemic dairy belt, this drives frequent misdiagnosis as typhoid, malaria or PUO.

2 **Urgent need for physician CME & training**

Structured Continuing Medical Education is needed, focused on early clinical suspicion, zoonotic history-taking and rapid LFA test kits.

3 **Identifying & targeting the right audience**

Interventions must specifically reach primary care physicians, rural health officers and general practitioners — the first contact for dairy farming families.

Mission: To make dairying a sustainable proposition to the small and marginal farmer by promoting scientific, cost-effective and holistic strategies.

Presentation overview



- Context
- Mastitis, AMR & One Health
- NDDB’s Mastitis Control Model
- EVM Rationale, Evidence, Field Results
- Impact and Endorsement
- Beyond Mastitis
- Collaborations
- Acknowledgements

Dairying in India



Largest producer in the world since 1998

- *248 million tonnes in 2024-25*
- *~25% of world milk production*

Production by masses

- *Average herd size is 2-3 animals*
- *Crop residue based production*
- *Contributes >5% of GVA*

Milk is the single largest agricultural commodity

- *Value >12.2 lakh crore (~129 billion USD) in 23-24, more than the combined value of cereals, pulses, oilseeds and sugarcane!*
- *~64% of total value of output from livestock (of the ~31% of agricultural GVA in 23-24)*

Growth above world average

- *Milk production grew at a rate ~5.1% annually against the world average of ~2.2% over the last decade.*

Employment generation

- *Provides direct employment to >80 million rural households*
- *~5-6% of rural employment*
- *~70% women*

Per capita availability above world average

- *Per capita availability in India is 485 g/day against the world average of 322 g/day*

Snapshot of common bovine diseases





Challenges in animal health





Limited veterinary care access and prohibitive treatment costs

Indiscriminate antibiotic usage





Probability of antibiotic residues in milk and milk products



Very low pace of development of new antibiotic molecules

Endemic to various diseases of economic importance



Lack of proper documentation and/or scientific validation of alternate systems like EVP



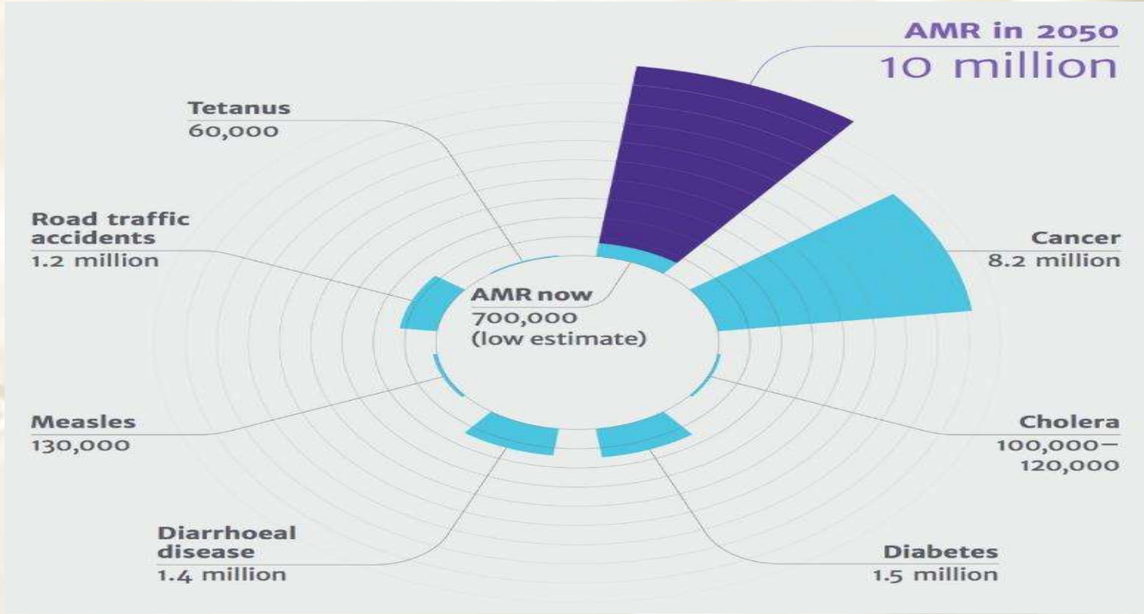


Rapid emergence of AMR

Increase in zoonotic diseases



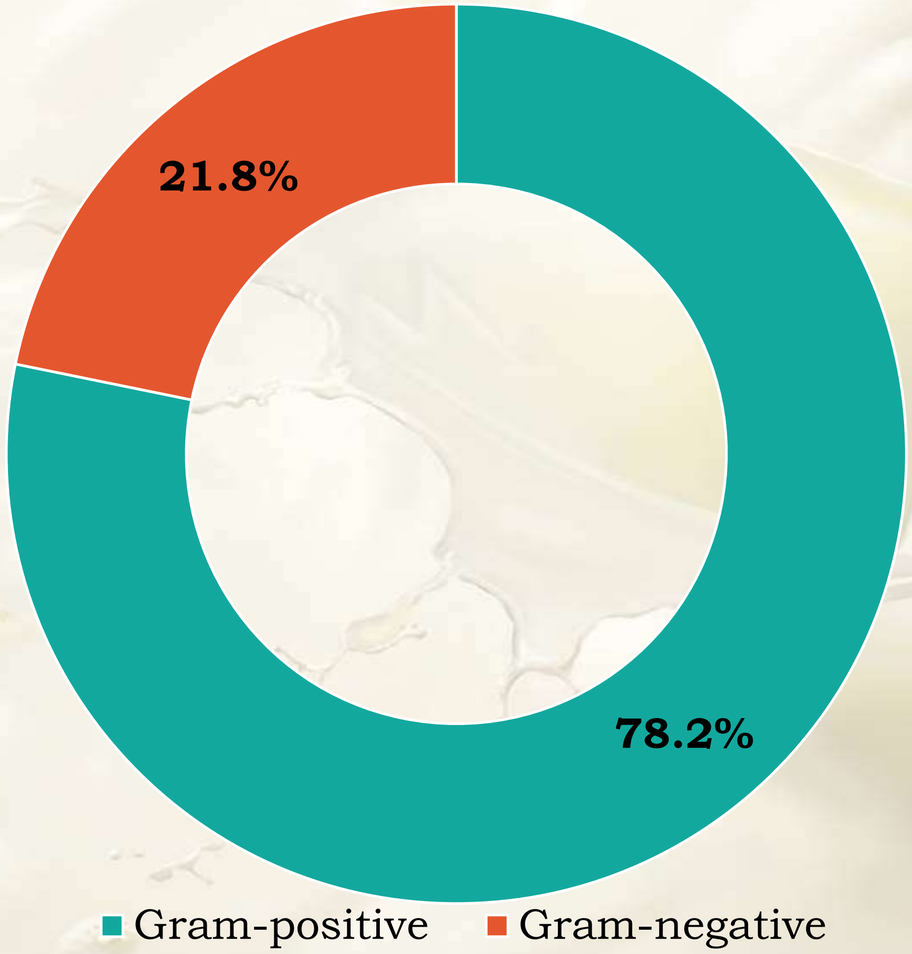
The AMR time bomb!



- 4.95 million deaths due to drug resistant infections in 2019 (~60k infants die in India due to AMR)
- 1 in 6 bacterial infections worldwide are resistant to standard antibiotics from results from laboratories in >100 countries (WHO, 2026)- *E.coli* and *K. pneumonia* dominate
    - >40% and >50% *K. pneumoniae* now resist 3rd generation Cephalosporins used for blood stream infections. In some African countries bloodstream infection resistance already is >70%
    - Carbapenem resistance rising in *E.coli, Klebsiella, Acinetobacter* and *Salmonella* infections.
    - Resistance to fluoroquinolones also noticed
- Loss of $100 Trillion worth of economic output by 2050
- Global GDP reduction of 2-3.5% by 2050

Gram-positive bacteria dominate: roughly 4 in 5 isolates:

(159 clinical mastitis cases processed in 2025-26 from 8 States)



Gram-positive

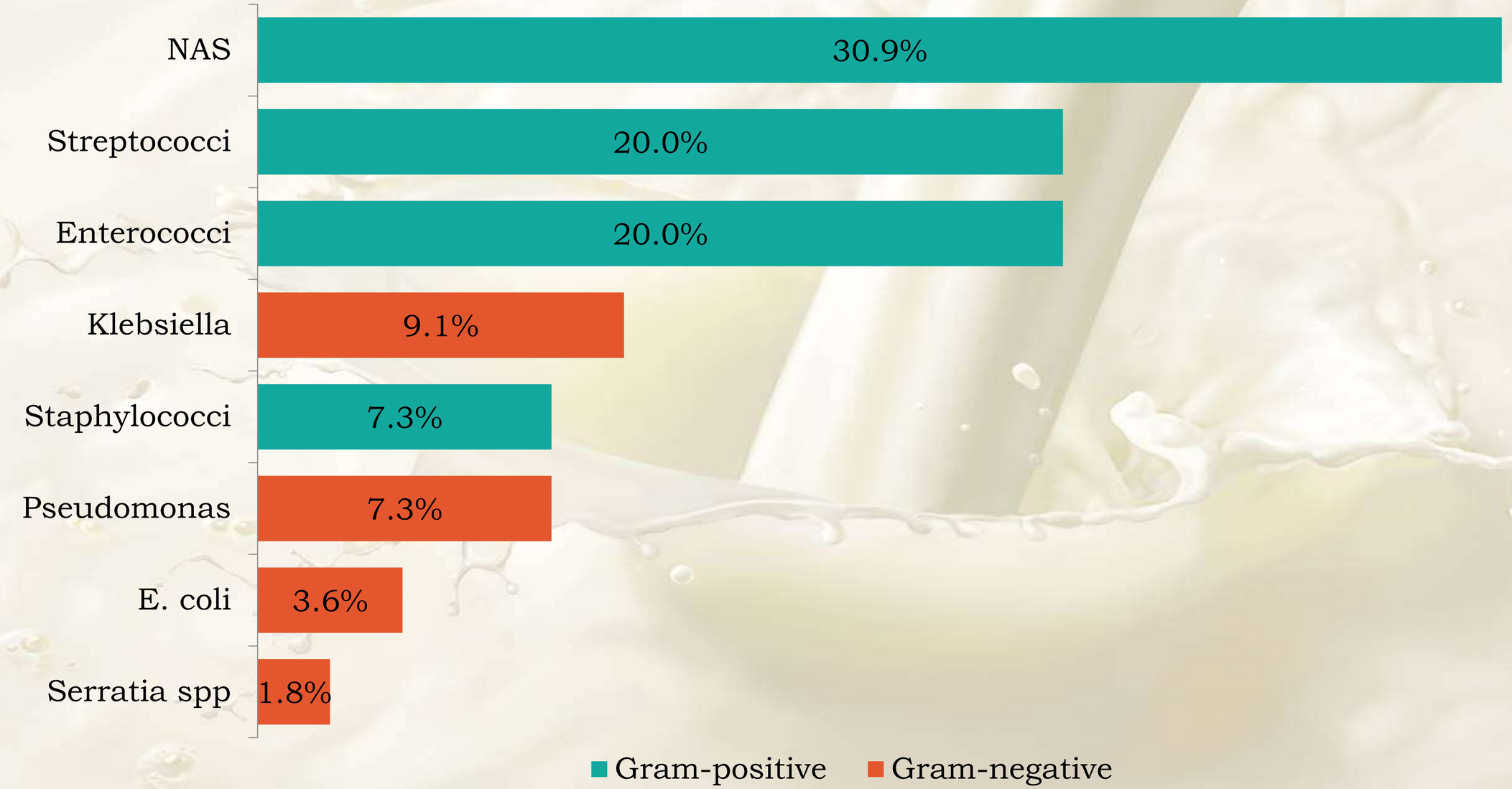
Non Aureus Staphylococci (NAS) · Streptococci · Enterococci · Staphylococci

Gram-negative

Klebsiella · Pseudomonas · E. coli · Serratia spp.

NAS lead the pack; Klebsiella tops the Gram-negatives

(from 159 clinical mastitis cases processed in 2025-26)



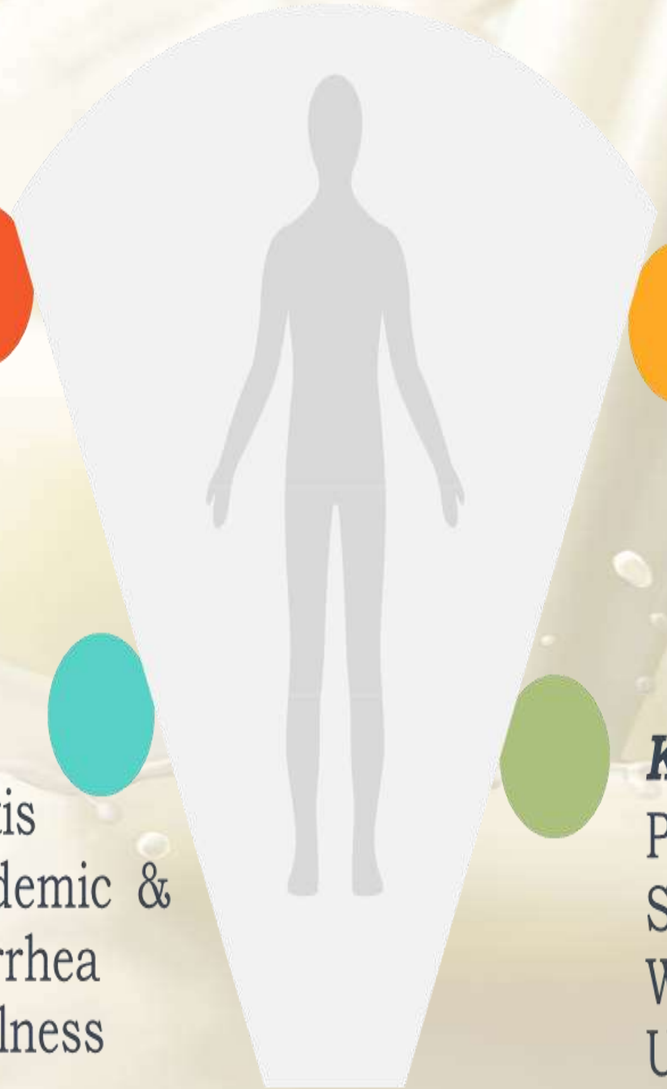
One Health- Mastitis & AMR

Staphylococcus aureus

Pneumonia
Septicemia
Wound infections
MRSA

Streptococcus agalactiae

Humans are reservoirs
Neonatal pneumonia and septicaemia
Skin & soft-tissue infections
Purpureal fever (postpartum infection)



E. coli

Gastroenteritis
Infantile, epidemic & Sporadic diarrhea
Food borne illness
UTIs

K. pneumoniae

Pneumonia
Septicemia
Wound infections
UTIs

The Mastitis Control Concept



1. Detection and control of subclinical mastitis

1. Awareness creation in villages

2. CMT at DCS

Pooled milk sample from each farmer to identify those with CMT+ve animals

3. Identify CMT +ve animals at farmers' homestead

Farmers also trained to test

4. Oral supplementation of TSC to CMT +ve animals

Parenteral treatment in unresolved cases

5. Identification of chronically infected animals

2. Detection and management of chronically infected animals

Management of chronically infected animals

Dry cow therapy

6. Rationalizing antibiotic usage

EVM

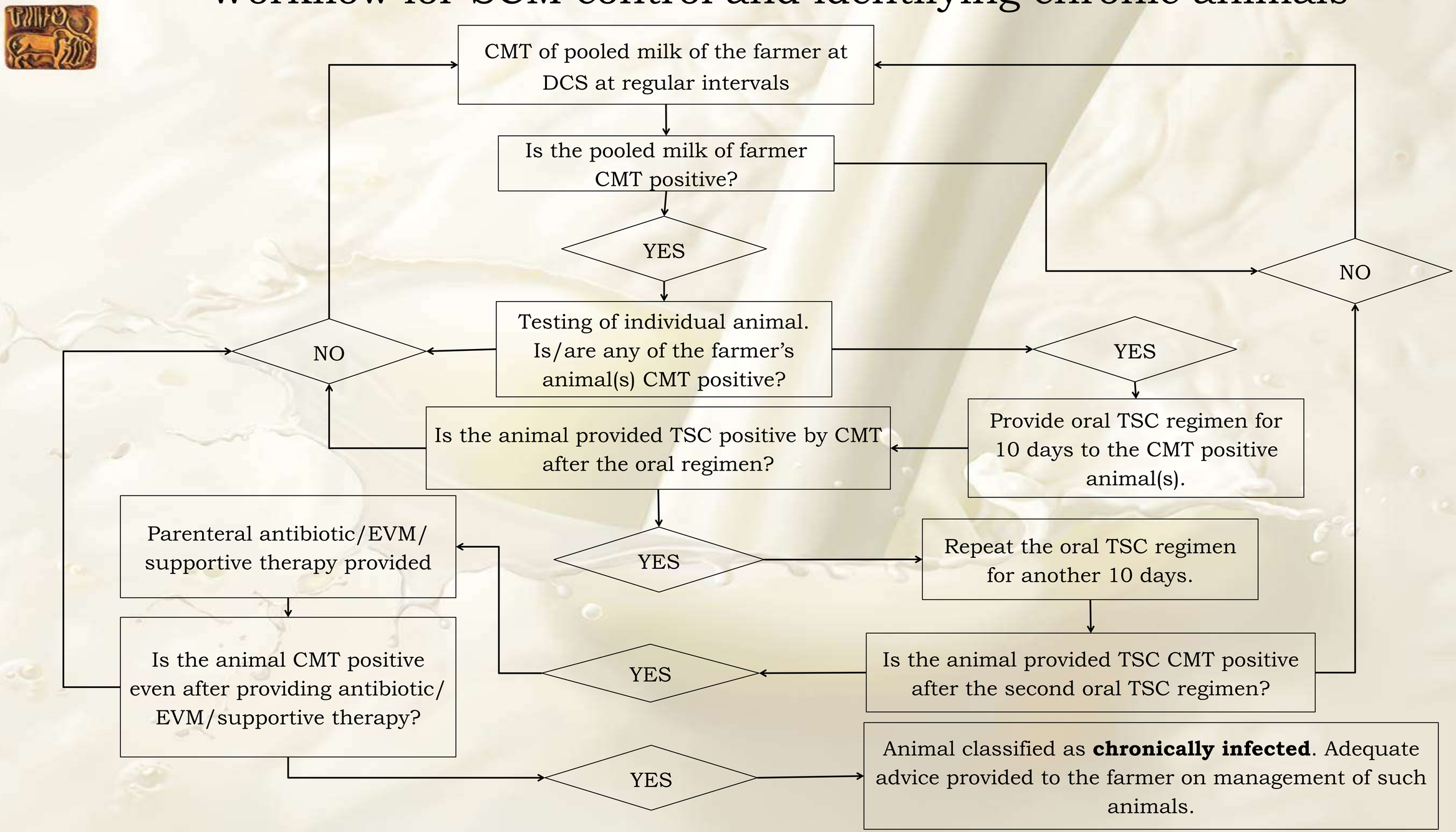
Homeopathy

Field antibiotic kits

3. Use of EVM for treating clinical mastitis cases

One health approach

Workflow for SCM control and identifying chronic animals



Antimicrobial Resistance Surveillance Report

NATIONAL DAIRY DEVELOPMENT BOARD

Mastitis Control Popularization Project
Antimicrobial Resistance Surveillance Report

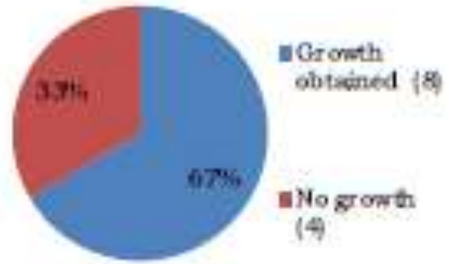
Name of the Milk Union : Kolhapur Milk Union

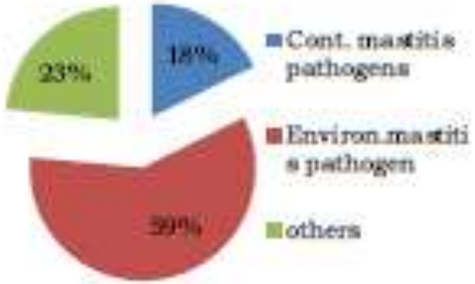
No.of samples dispatched : 12 No.of samples tested: 12

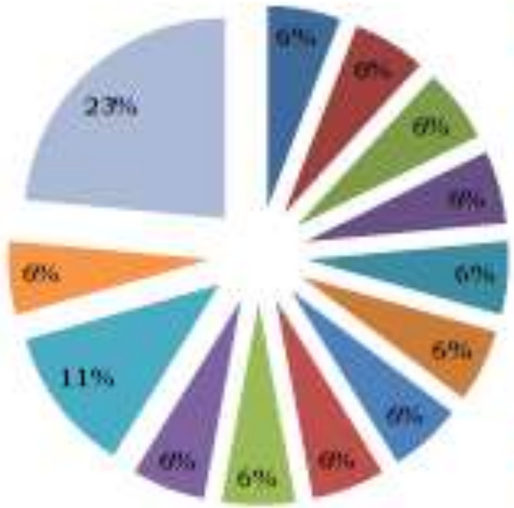
Tested at : NDDB R & D Laboratory, Hyderabad

Result

1. Isolates







2. Antibiogram

Gram+ve isolates	Ampicillin	Penicillin	Gentamycin	Levofloxacin	Moxifloxacin	Oxytetracycline	Erythromycin	Trimethoprim	Cefazolin	Clindamycin	Daptomycin	Linezolid	Nitrofurantoin	Norfloxacin	Oxacillin	Quinupristin-dalfopristin	Rifampin	Teicoplanin	TMP-Sulfamethoxazole	Vancomycin
Staphylococcus aureus	R	R	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Staphylococcus epidermidis	R	R	S	S	S	R	S	R	R	S	S	S	S	S	R	-	S	S	S	S
Streptococcus uberis	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	S	S	S	S
Staphylococcus haemolyticus	-	-	S	S	S	S	S	S	S	S	S	S	S	S	S	-	S	S	S	S
Streptococcus agalactiae (Strep. group B)	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Gram-ve isolates	Ampicillin	Piperacillin	Cefotaxime	Gentamycin	Ciprofloxacin	Levofloxacin	Oxytetracycline	Chloramphenicol	Trimethoprim	Amikacin	Amoxicillin-Clavulanate	Ampicillin	Aztreonam	Cefazolin	Cefepime	Cefoxitin	Ceftazidime	Imipenem	Meropenem	Piperacillin-Tazobactam	TMP-Sulfamethoxazole
Burkholderia gladioli	R	S	S	S	R	R	S	S	S	S	R	R	R	R	R	R	R	S	-	S	S
Pantoea agglomerans (2 isolates)	S	S	-	S	S	S	S	S	S	S	S	S	R	S	R	S	R	S	S	S	S
Klebsiella pneumoniae	R	S	S	S	S	S	S	S	S	S	S	R	S	-	S	S	S	S	S	S	S

Resistant Sensitive

The results are only indicative since the sample size is very small. Continuous sampling would be required to generate meaningful data.

EVM rationale



Farmer

- Cost-effective
- Easy to prepare & administer
- Ingredients easily available at home
- Efficacious and revitalising
- Non-invasive
- No milk withdrawal
- Provides an immediate option in remote areas

Consumer

- Reduced antibiotic residues/other drugs in milk.
- Better product quality
- Reduced food allergies
- Better health

Country

- Implementation of regulatory agency (FSSAI) norms
- International recognition of Indian Traditional systems
- Better prospects in international market
- Help to tackle AMR

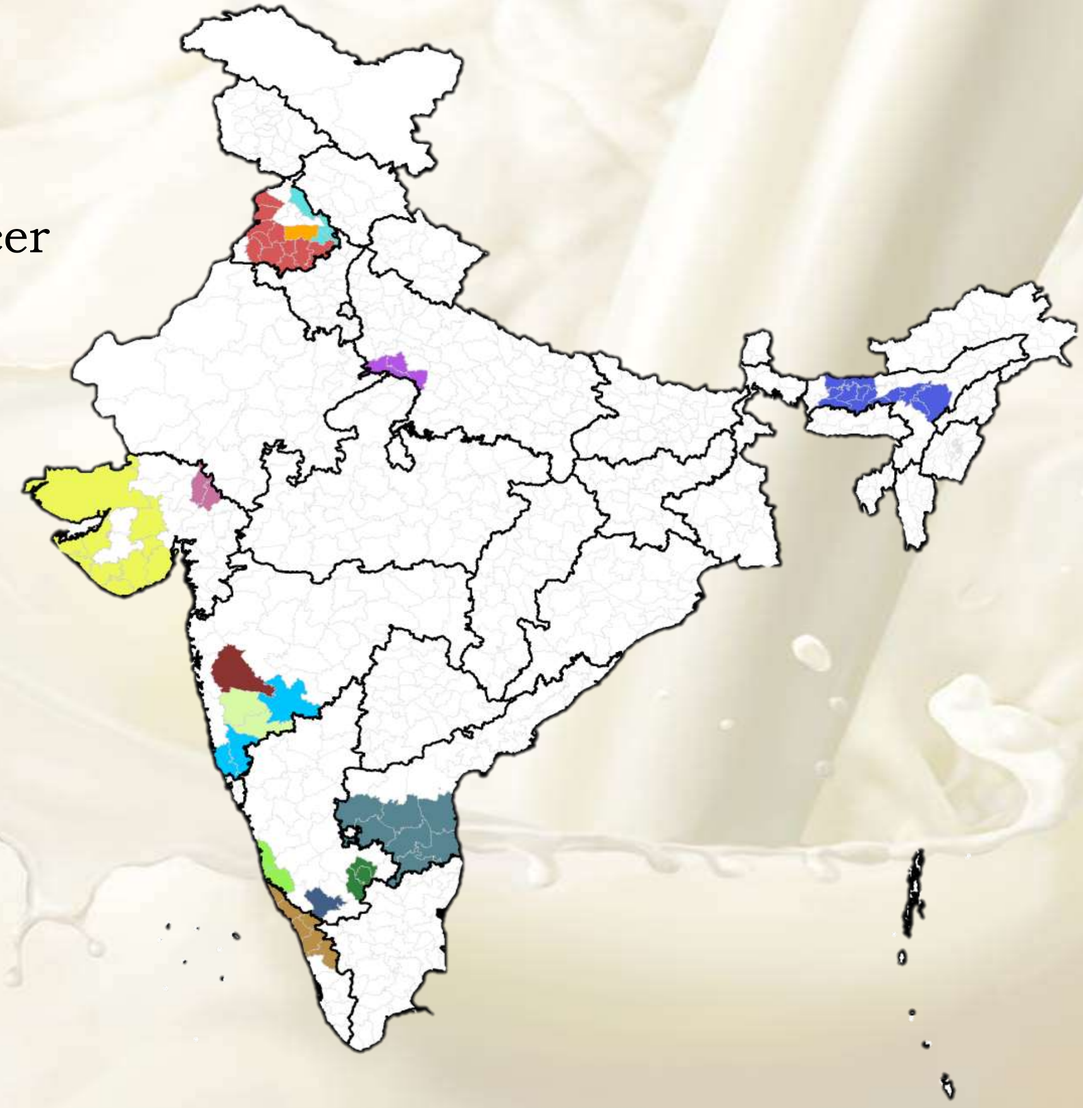
Climate

- Antibiotic free dung improves carbon sequestration of the soil by almost double (soil stores twice as much carbon as the atmosphere does)

EVM coverage

Project coverage

- >1800 DCSs
- 12 Milk Unions/Producer Companies
- 8 States



Period

- Since 2017-18

Training on EVM

- 1496 vets trained
- 13545 AH personnel

Case records

- >13.69 lakh cases recorded for various ailments

Demo plots

- 835 demo plots established

Training of vets from on EVM









Training of vets at TDU, Bangalore on EVM and antibiotic residue field testing



Erode



Bangalore



Kolhapur



Vijayawada



Mehsana



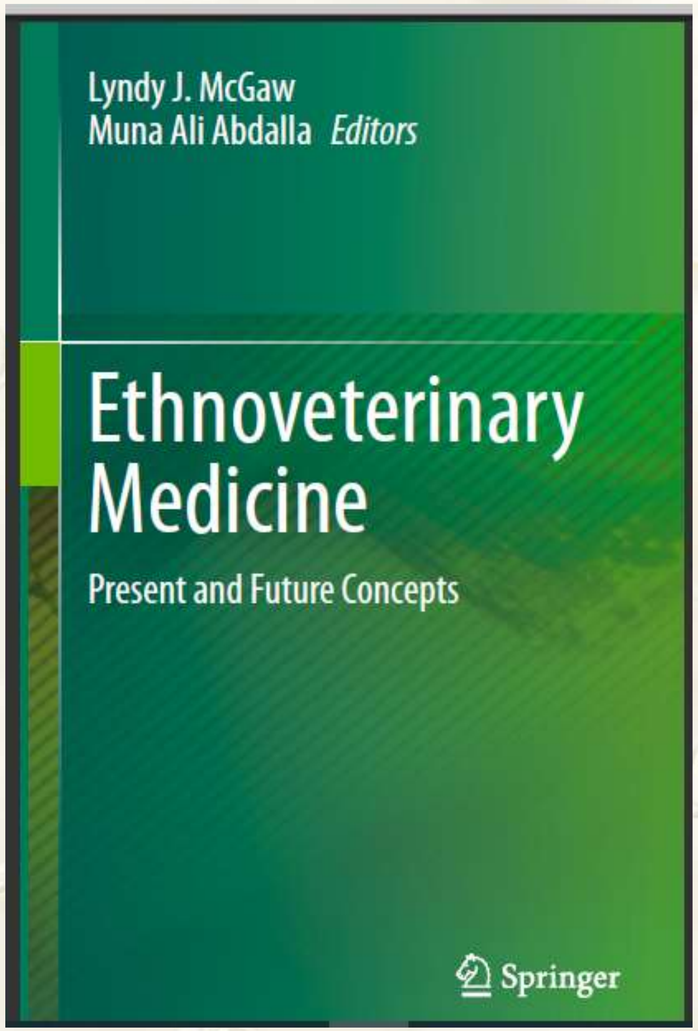
Mysore

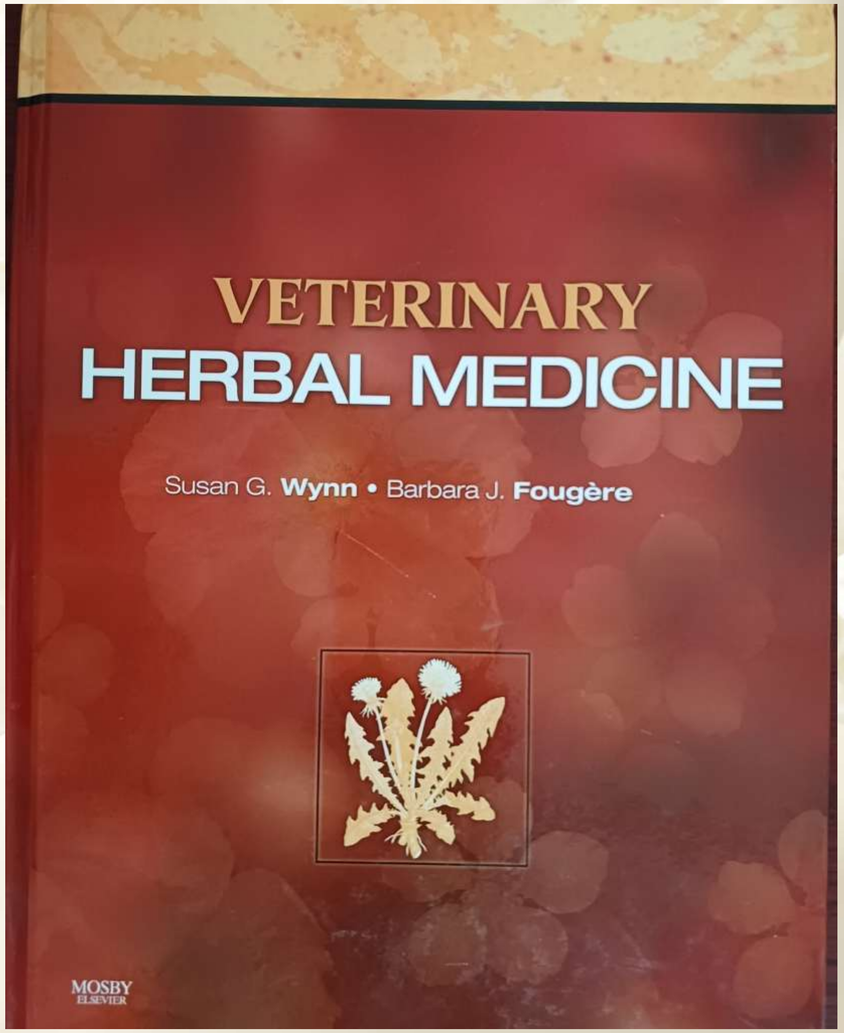


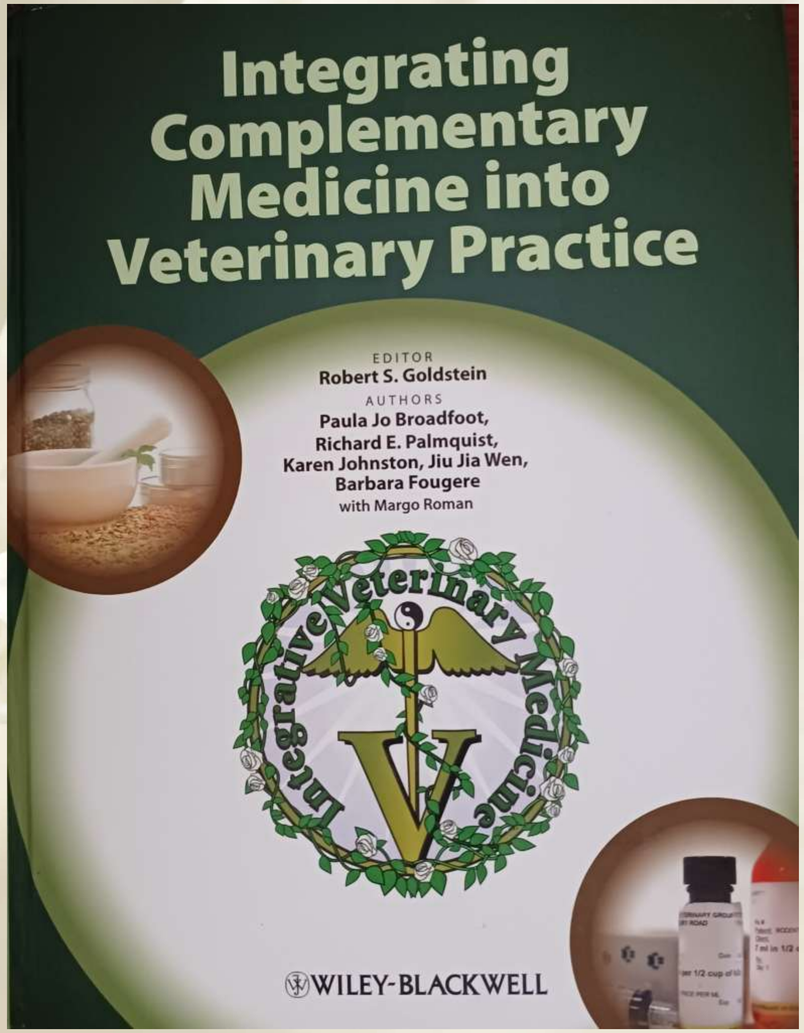
Mohali

The 4 day training at TDU followed by a 3 day field training at various locations across the country

Textbooks on EVM







DATA CAPTURE

Empowering Dairy Health through Data

AILMENTS

- Mastitis
- Bloat
- Blood in milk
- Deworming
- Diarrhoea
- Downer
- Ectoparasites
- Fever
- FMD foot lesion
- Prolapse
- Repeat breeder
- Teat obstruction
- Udder Oedema
- Wart
- Wound

AILMENTS

- ROP
- Swelling of joints
- Leucoderma
- Anoestrus
- Endometritis
- Milk fever
- Joint ill
- Teilitis
- Metritis
- Pyometra
- Cystic ovary
- Poisoning
- Indigestion
- Agalactia
- LSD

13,69,838
EMPIRICAL RECORDS

~81% cure rate
>1,14,910 individual records (2026)

~82% cure rate



8100 CASES
with 78% cure rate
in 2017-18

DATA CAPTURED
THROUGH AN
ONLINE SYSTEM

Healthier Animals | Better Productivity | Stronger Dairy Future

EMPIRICAL DATA vs INDIVIDUAL ANIMAL DATA

EMPIRICAL DATA

DIARRHOEA

193429 / 230212
(Empirical records)

84%

FEVER

219168 / 270223
(Empirical records)

81%

MASTITIS

397195 / 496381
(Empirical records)

80%

INDIVIDUAL ANIMAL DATA

19488 / 22954
(Individual animal records)



85%

27493 / 33177
(Individual animal records)



83%

38473 / 49526
(Individual animal records)



78%



STRONGER INSIGHTS
Data-driven decisions for better animal health

HIGHER ACCURACY
Individual data captures the complete picture

BETTER OUTCOMES
Healthier animals, higher productivity

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Manager (Animal Health),

Management of common ailments of dairy animals with ethno-veterinary herbal preparations in Gujarat

P Dutta, AV Hari Kumar, SK Rana, SB Patel, DD Patel, KR Patel, N Punniamurthy, MNB Nair and GK Shrama

Indian J Dairy Sci 73(5): 383-391
https://doi.org/10.33785/IJDS.2020.v73i05.001

INVITED REVIEW

Ethnoveterinary medicine for responsible dairying

Dilip Rath[1], Girish Kumar Sharma[1] and Yogesh C Joshi[2]

Received: 17 September 2020 / Accepted: 23 September 2020 / Published online: 27 October 2020
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Indian J. Comp. Microbiol. Immunol. Infect. Dis.
Vol. 42 (Special Issue) November, 2021: 83-87
Technical Article

USE OF ETHNOVETERINARY MEDICINE FOR MANAGEMENT OF COMMON AILMENTS OF DAIRY ANIMALS

S.K. Rana[1]*; A.V. Harikumar[1], P. Dutta[2], S. Shroff[1], S.K. Dash[1], N. Punniamurthy[1], M.N.B. Nair[2]

[1]National Dairy Development Board, PB No. 40, Anand-388001, Gujarat, India
[2]The University of Trans-Disciplinary Health Sciences and Technology, #74/2, Jakkasandra Kaval, Post Attur via Yelahanka, Bengaluru-560064, Karnataka, India

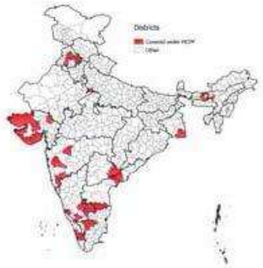
HEALTH – MASTITIS

Mastitis control: a sustainable model for the developing world

AUTHOR
S K Rana, A V Hari Kumar, Pankaj Dutta, K S N Leela Surendra, Vijay S Bahekar, Ponnanna N M, G K Sharma
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UN SDGs

SUMMARY
- Location: National Dairy Development Board's (NDDB) model for control of bovine mastitis titled Mastitis Control Popularisation Project (MCPP) is being implemented in more than 1500 dairy cooperative societies (DCS) across nine states in India (Figure 1) focusing on a simple, cost-effective, efficacious, environmentally friendly and sustainable approach.
- IDF Welfare Action Area: Animal Health management
- Resource based measures: (i) Reduction in treatment costs in bovine mastitis (ii) Dissemination of knowledge to the farmers, especially ethno-veterinary medicine (EVM) (iii) Management of many other common bovine ailments (other than mastitis) by EVM.
- Animal based measures: i) Increase in milk production (ii) High cure rates (iii) Non-invasive and therefore painless.



GLOBAL AGENDA FOR SUSTAINABLE LIVESTOCK

Good practices for responsible use of antibiotics



Testing of pooled milk samples by California Mastitis Test (CMT) at Dairy Cooperative Societies

System 3. Mastitis prevention in effective and sustainable dairy production system

Mastitis is the most important disease in dairy production. It has been responsible for up to 85% of the antibiotics used. During the last decades, a successfully large improvement in udder health has taken place. Udder health mismanagement can threaten human health due to zoonotic or antimicrobial resistant pathogens adapting different environment. High quality milk with low somatic cell counts is crucial for product quality and better organoleptic quality for consumers. Good prevention, management and excellent animal welfare will reduce food loss in the whole chain from barn to table. A tailored plan for each country and herd should be applied.

Diminishing mastitis to limit antibiotic use

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Dr. Pankaj Dutta
National Dairy Development

Case reports on management of LSD like conditions with ethno-veterinary practices

Dr. Pankaj Dutta, AV Hari Kumar, AC Mahajan, S Shroff, SK Rana, PJ Sahariah, P Gogoi, D Borah, N Punniamurthy and MNB Nair

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Manager (Animal Health),

Management of repeat breeding in bovine by herbal combination

Dr. Pankaj Dutta, Harikumar AV, Shroff SI, Rana SK, Mogale UV, Magare V, Punniamurthy N, Nair MNB and Gorhe SB

Down to Earth Report



EASY TO SWITCH

Ethnoveterinary medicine is a low-cost alternative to reduce antibiotic use in Indian dairy sector

DEEPAK BHATI, RAJESHWARI SINHA, AMIT KHURANA

NEW DELHI

SOME LIFESAVING solutions are so simple and obvious that they remain hidden in plain sight. This is particularly true for livestock disease treatments that have evolved over generations through experiences of communities, withstood the test of time and are embodied in local culture and practices. Yet the knowledge remains untapped in the absence of standardisation and scientific validation. More often than not, dairy farmers, and some field veterinarians, indiscriminately use crucial antibiotics for treating even benign infections in animals.

Researchers with Delhi-based Centre for Science and Environment found evidence of such rampant misuse and overuse of antibiotics during consultations with dairy farmers and experts from sectors, including animal husbandry, food safety, human health, conducted in 2020 and 2021. CSE had observed that most dairy farmers also skip the critical withdrawal period—a prescribed number of days during which treated animals should be excluded from the milk supply chain to allow antibiotic residues excreted out of the body. In 2018 the Food Safety and Standards Authority of India (FSSAI) also found antibiotic residues in milk samples.

Such abuse of antibiotics not only adds to the treatment costs, but also adds to the growing burden of antimicrobial resistance (AMR). Interaction between antibiotic residues and pathogens in various environmental matrices (soil and water) and in humans lead to the formation and spread of bacteria that are resistant to antibiotics. A study published in peer-review journal *The Lancet* in January 2022 says in 2019 alone, 4.95 million deaths were associated with bacterial AMR across the world, with 1.95 million deaths directly attributable to bacterial AMR.

"Antibiotic residues interfere with the manufacture of several dairy products by delaying starter culture activity for buttermilk, *shrikhand* (a dessert made with yoghurt), curd and other fermented products," says Anilkumar Bayati, managing director of Sabarkantha district co-operative milk producers' union, also known as Sabar Dairy.

One common infection among dairy animals that prompts farmers to depend on antibiotics is mastitis, triggered by rough milking or any other injury to the udder tissue and due to unhygienic farm conditions. Since the infection is caused by over 100 types of microorganisms such as bacteria, fungus and virus, there is no vaccine against it. The infection causes inflammation of mammary glands and blockage of milk ducts, and manifests in change of milk colour, consistency or even blood in milk. Milk yield also reduces. A review of studies in 2021 by National Institute of Veterinary Epidemiology and Disease Informatics, the only institute conducting surveillance and monitoring of animal diseases, states that 18 per cent dairy animals in the country suffer from clinical mastitis, while 45 per cent display subclinical mastitis (it shows no specific symptom except a slight decrease in milk yield). "Dairy farmers lose up to 3-4 liters of milk per animal per day because of mastitis," says A V Hari Kumar, deputy general manager, animal health, at the National Dairy Development Board (NDDB). Now call it lack of enough field veterinarians in the country, or easy over-the-counter access to antibiotics or the fear of losing milk, and therefore, income, most dairy farmers rush to administer high doses of antibiotics to the cattle even at the slightest sign of mastitis.

For managing such common ailments and rationalise drug usage, especially antibiotics, NDDB in 2014 launched a project, Mastitis Control Popularisation Programme (MCPP). The programme, piloted at Sabar Dairy, initially focused on early detection of mastitis so that the animal can be treated using simple methods. Milk brought to the society by the farmer was checked using a tool California Mastitis Test (CMT). If the milk tested positive for mastitis, the farm was traced back, the animal was identified and was given an oral regimen trisodium citrate. After 10 days, the animal was tested again. A trial on 218 animals found that two consecutive trisodium citrate treatments led to 89 per cent recovery. This is when MCPP turned its focus to ethnoveterinary medicines.

It joined hands with Sabar Dairy and the University of Trans-Disciplinary Health Sciences and Technology (TDU), in Bengaluru, which had already been researching on ethnoveterinary medicines. In 2016, they conducted a trial on 30 cows

REVIVING LOST WISDOM

2013
Mastitis identified as one of the major animal health issues based on ear-tagging data

2014
National Dairy Development Board (NDDB) launched Mastitis Control Popularisation Programme (MCPP)

2016
Ethnoveterinary medicines (EVM) integrated into MCPP

2017
NDDB along with University of Trans-Disciplinary Health Sciences and Technology prepares brochure for farmers for important bovine ailments in 12 vernacular languages

2019
Sabar Dairy starts manufacturing and packaging of EVM products Facebook page on traditional herbal formulations for cattle and buffaloes created

2020
Mastitis cases of Sabar Dairy treated with 85% cure rate using EVM; between 2017-eGopala mobile app launched

2021
eGopala web version launched; Kaira milk union (Amul dairy) started manufacturing and packaging of EVM products

2022
So far, 576 demonstration plots established by milk unions under NDDB guidance; trained 260 core group of veterinarians from 34 milk unions and producer companies; licensed EVM products launched

Source: Centre for Science and Environment

Scientific validations

ANTI-INFLAMMATORY, ANTI-MICROBIAL AND ANTI-MASTITIS EFFECT OF ETHNO-VETERINARY FORMULATION: POSSIBLE ROLE IN INFLAMMATORY SIGNALING CASCADES

PROJECT PROPOSAL SUBMITTED

TO

NATIONAL DAIRY DEVELOPMENT BOARD
Anand, Gujarat

By

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&
Dr. Sandya S (Co-PI)
Inorganic and Physical chemistry
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Anand-388001

NDDB Project Report:

Title of the Project: Validating efficacy of the EVM formulation for immunity enhancement

The salient observations are as follows:

1. **Haematological parameters:**

- The number of RBCs increased significantly (<0.05) in the supplemented group as compared to the non-supplemented (Control) group indicating supplementation of the EVM

PROJECT PROPOSAL

TO EVALUATE THE EFFECT OF HERBAL FORMULATION AND TRADITIONAL PLANT EXTRACTS AGAINST TICK-INFESTED CATTLE

A PROJECT SUBMITTED
TO

NATIONAL DAIRY DEVELOPMENT BOARD
Govt. of India

BY
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KB 35 Nature Positive Food Systems

Deliverable D2.2b

A case study on the practice of Ethnoveterinary Medicine in India in the context of Nature Positive Food Systems

Lérica le Roux-Pullen[1], Tania Mubita Zambrano[2], Balakrishnan Nair[3]

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1. Introduction

Transforming food systems to be more nature-positive requires actions that both minimise harming the environment and actively contribute to biodiversity restoration and enhancement. Given the food

Assessment parameters of EVM formulation for mastitis

- HPLC Profiling
- Antibacterial Property
- Cytotoxity Evaluation
- Cell migration (healing)
- ROS, NO, Lipid peroxidation, NAgase Levels – Oxidative stress
- Antioxidant enzyme activities – SOD, CAT, GPx
- Pro-inflammatory cytokines – IL-1β, IL-6, TNF-α
- Gene Expression - NF-κB p65, iNOS ,TLR2
- Molecular Docking Studies
- In-vivo- lactating rats

EVM formulation for mastitis- The Multitarget Advantage!



Multi-Target Efficacy

Curcumin, Aloin, Emodin, Lupeol, Turmerone—demonstrated significant binding to **COX-2, IL-6, TNF-α, NF-κB, iNOS**, highlighting their broad-spectrum anti-inflammatory potential.

Curcumin and Emodin as Core Inhibitors

These compounds showed consistently strong binding across all targets, indicating their central role in suppressing inflammation and modulating immune responses.

Synergistic Potential of Aloin and Turmerone

Aloin and Turmerone displayed complementary target affinities and can enhance the therapeutic effect when used in combination with other components

Mechanistic Coverage

Together, these compounds inhibit both upstream (e.g., IL-6, NF-κB) and downstream (e.g., COX-2, iNOS) inflammatory pathways, enabling interruption of the entire inflammatory cascade.

Inflammation ↓ | Tissue injury ↓ | Healing ↑

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ELSEVIER

Microbial Pathogenesis

Available online 15 September 2025, 108041

In Press, Journal Pre-proof What's this?



Inhibitory Effect of an Ethnoveterinary Oil and Water Formulation on LTA-Induced Mastitis via TLR2/NF-κB Signaling in Mammary Epithelial Cells

Ratheesh M [1], Svenia P. Jose [1], Sheethal S. [1], Sony Rajan [1], Sandya S. [2]

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Journal of Molecular Histology (2026) 57:290
https://doi.org/10.1007/s10735-026-10953-6

ORIGINAL PAPER

Therapeutic potential of an ethnoveterinary formulation against *Staphylococcus aureus*–induced mastitis via modulating TLR-2/NOX-2 pathway

M. Ratheesh[1] · Sveniа P. Jose[1] · S. Sheethal[1] · S. Sandya[2] · Parul Dhar[3] · Deeksha Pandit[4]

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Abstract

Mastitis is a major inflammatory disorder of the mammary gland that causes substantial economic losses in the dairy industry, with *Staphylococcus aureus* (*S. aureus*) being one of the predominant causative pathogens. The current treatment options are limited by antimicrobial resistance and drug residues. Therefore, alternative therapeutic strategies are needed. The present study aimed to evaluate the anti-inflammatory and antioxidant effects of an ethnoveterinary oil (EO) formulation in an experimental model of *S. aureus*–induced mastitis. The EO formulation was prepared according to a standardized traditional ethnoveterinary composition. Mastitis was induced in healthy lactating primiparous Wistar rats by intramammary infusion of *S. aureus* (2×10^8 CFU/mL), and the twenty-four female Wistar rats were divided into four groups of 6: normal control (NC), mastitis control (MT), standard drug–treated (MT + DEX), and MT + EO-treated groups. The chemical composition of EO was characterized by GC–MS analysis, which identified 21 bioactive compounds, predominantly erucic acid, along with phenolic compounds, fatty acid derivatives, terpenoids, and steroidal constituents known for their anti-inflammatory potential. Biochemical analyses revealed that EO significantly restored endogenous antioxidant enzyme activities and reduced lipid peroxidation in mammary tissues. Furthermore, EO significantly decreased myeloperoxidase (MPO) levels and *N*-acetyl-β-D-glucosaminidase activity, indicating reduced neutrophil infiltration and protection against epithelial cell damage. The levels of Pro-inflammatory cytokines were markedly elevated in mastitis control group whereas EO treatment significantly suppressed their production. In addition, EO downregulated the gene expression of Toll like receptor-2 (TLR-2) and Nicotinamide adenine dinucleotide phosphate (NADPH) oxidase 2 (NOX-2), suggesting modulation of key inflammatory and oxidative stress–related pathways. Histopathological and special staining analyses further confirmed the preservation of mammary gland architecture and attenuation of inflammatory infiltration following EO treatment. Collectively, these findings demonstrate that EO exerts potent anti-mastitic effects through the combined modulation of oxidative stress and inflammatory responses and may serve as a promising natural therapeutic alternative for the management of *S. aureus* associated mastitis in Wistar rat model.

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Published online: 30 August 2026

Assessment parameters & Salient Findings of EVM formulation for Fever

Parameters assessed

1. In silico evaluation
2. Anti-inflammatory effect in carrageenan-induced inflammatory model
3. Anti-inflammatory effect in adjuvant-induced chronic inflammatory model.
4. Anti-pyretic mechanism in brewer's yeast-induced pyrexia model
5. Anti-inflammatory effect through modulation of signaling pathways in vitro (RAW 264.7 macrophages)

Salient Findings

1. Turmerone, α-turmerone, caryophyllene and piperine are the major bioactive compounds responsible for the anti-inflammatory and antipyretic activity.
2. It possesses potent anti-inflammatory activity against acute inflammation through suppression of prostaglandin E-2 (PGE-2)- mediated inflammatory pathways.
3. It effectively suppresses chronic inflammation through modulation of inflammatory mediators and cytokines and, also preserves tissue integrity.
4. It exerts potent antipyretic activity through suppression of cyclooxygenase-2 (COX-2)/PGE-2 and, Mitogen-Activated Protein Kinase (MAPK)-mediated inflammatory signalling.
5. It exerts anti-inflammatory and antipyretic effects through modulation of Toll Like Receptor 4 (TLR 4)/Nuclear Factor-kappa B (NF-κB), COX-2/PGE-2, Poly (ADP-Ribose) Polymerase 1 (PARP-1) and, Nuclear Factor Erythroid 2-Related Factor 2 (Nrf2)/ Heme Oxygenase-1 (HO-1) signaling pathways.

These multi-level mechanisms provide strong scientific evidence that the EVM formulation for fever is a very promising multi-target natural therapeutic candidate for mitigating inflammatory and pyretic responses while also providing cellular protection against oxidative stress.

LSD: before and after EVM

In a Gaolao cattle breed, Kharangana village, Arvi tehsil, Wardha Dist, Maharashtra



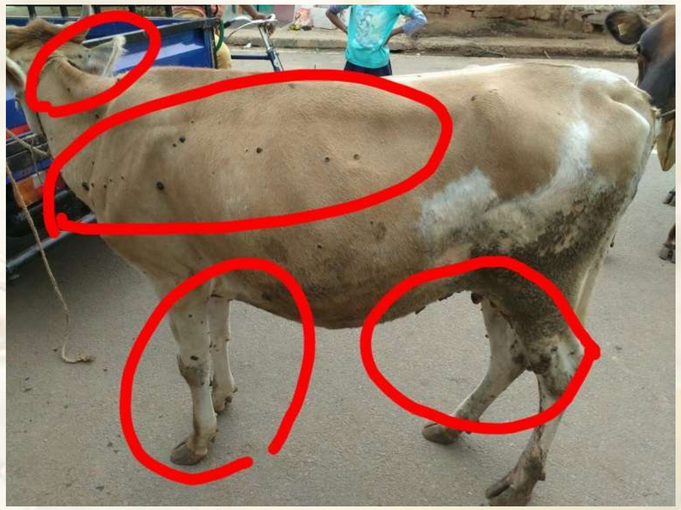
Before EVM



On 7th day of EVM Treatment

EVM for Warts/Cracks

Before treatment





After treatment





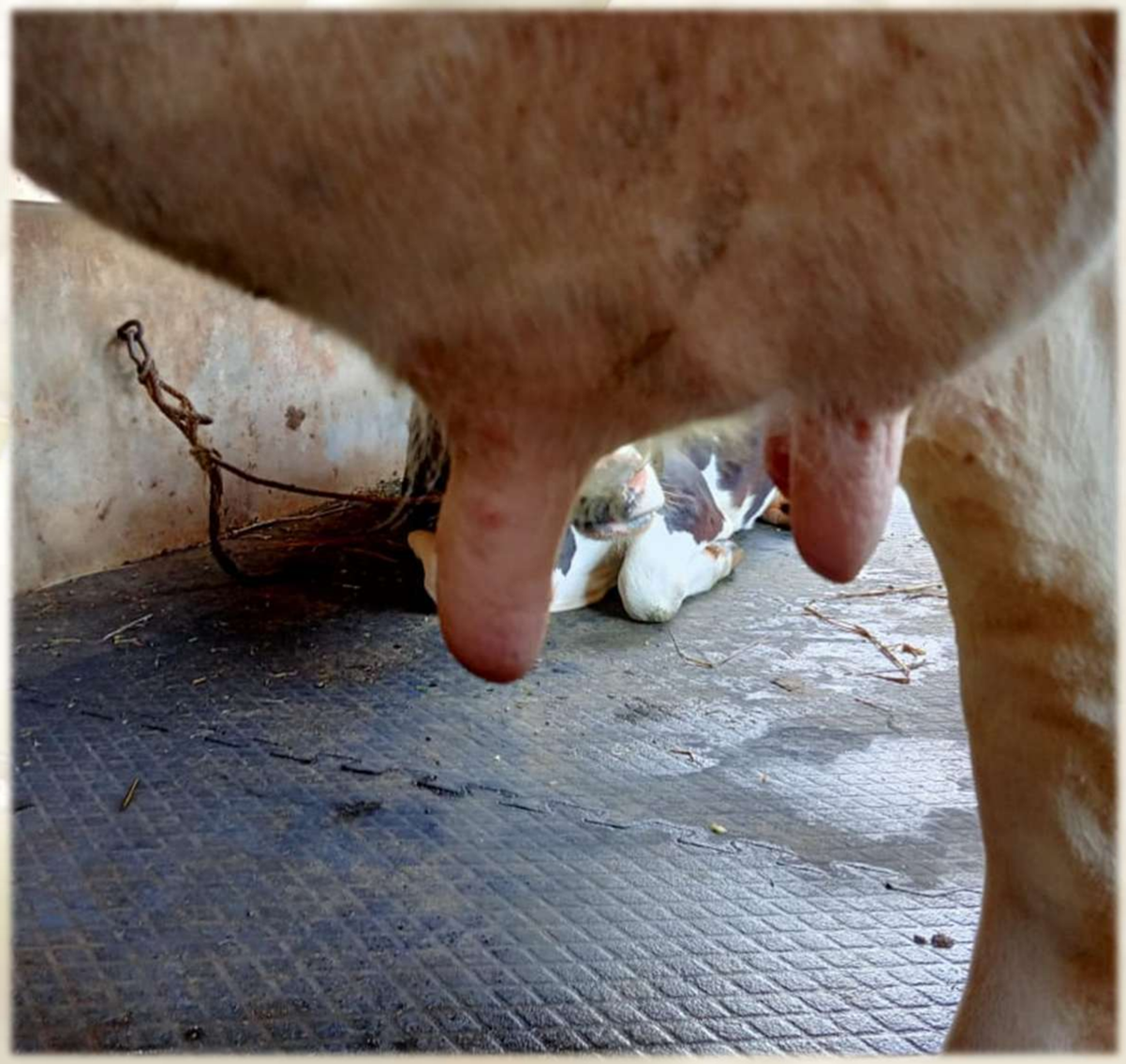
Wart- Before & after EVM





Wart- Before & after EVM





Major reasons for Repeat Breeding



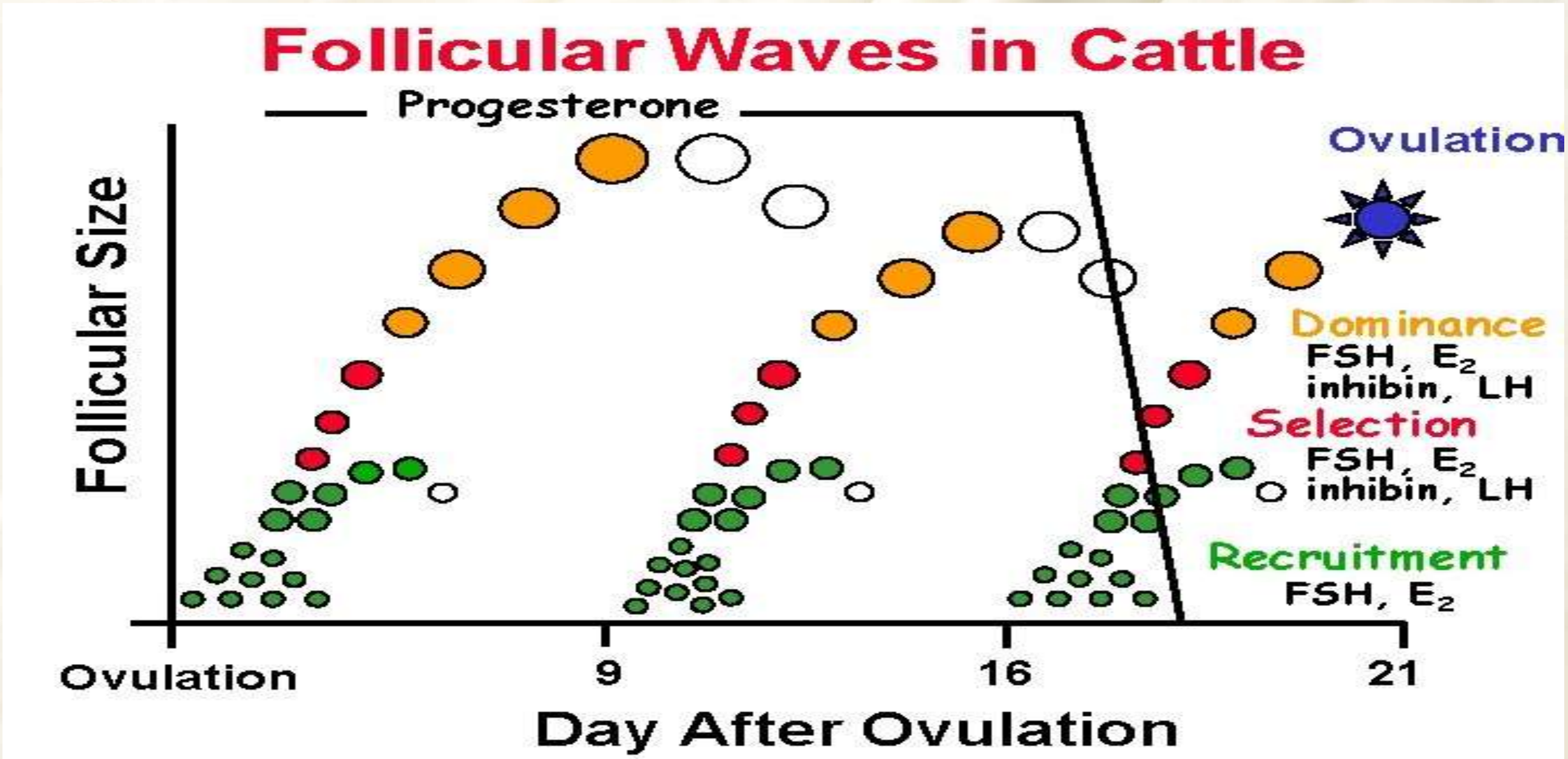
- Uterine infection
- Reduced intensity of heat especially in high yielders.
- Low insulin levels
- Selenium deficiency
- Hormonal issues
- Lesser number of follicular waves
  - Follicular waves (5-10 each) occur 0,9,16 days after ovulation
  - In absence of 3rd wave, ovum becomes senile (12-13 days old) by the time of ovulation reducing conception rate

EVM is able to address the above issues of repeat breeding to a great extend

Other reasons :

- High oestrogenic feeds
- Stress including heat stress – leads to conception failure
- Excess soluble protein in diet- Increases serum urea nitrogen
- Nutritional – negative energy, insufficient protein, gossypol
- Semen and artificial insemination related issues

Major reasons for Repeat Breeding

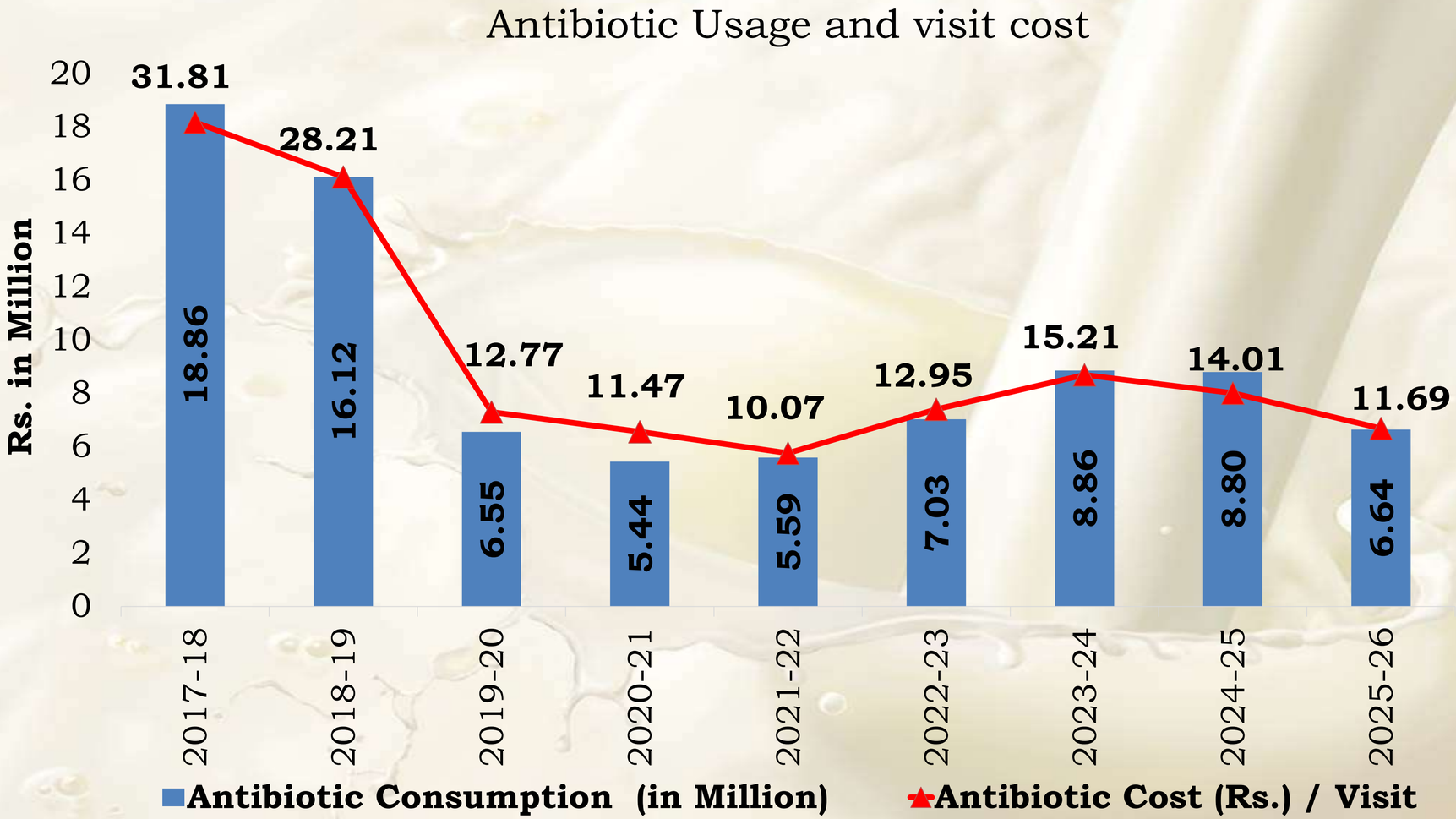


Conception/calving rates following EVM intervention in repeat breeding cases

Cattle		Buffalo		C+B	
Total	Conceived	Total	Conceived	Total	Conceived
35	26 (74.3%)	73	58 (79.5%)	108	84 (77.78%)

- All the conceived animals completed the full term pregnancy and successfully calved

Antimicrobial Usage (AMU) Reduction in a Milk Union





65%

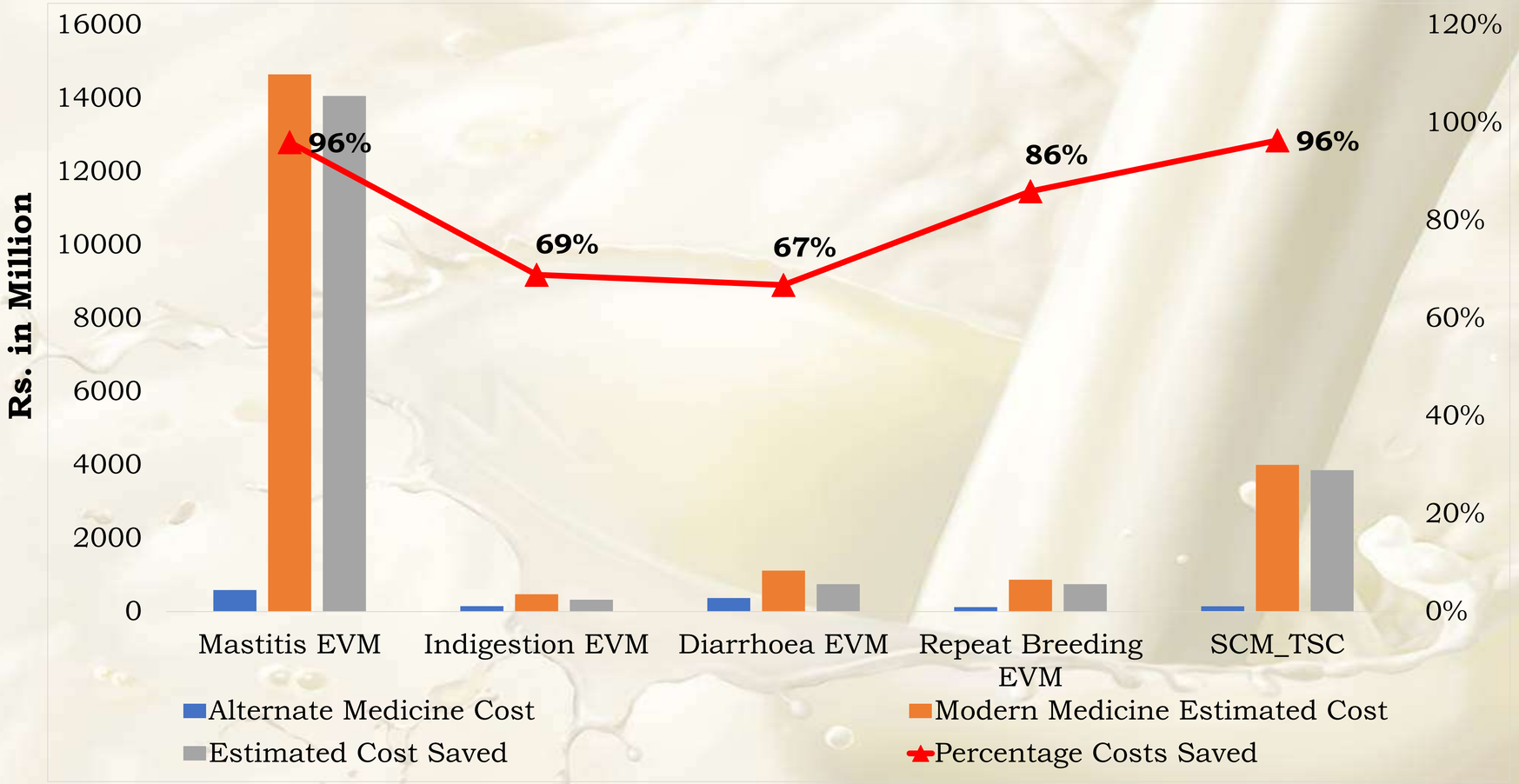
Reduction in antimicrobial usage (AMU)



63%

Reduction in antimicrobial cost per visit

Cumulative Cost Savings



Treatment Costs (Rs)*		
Ailment	**Modern**	**EVM**
Mastitis	3000	120
Wound	962.5	60
Bloat & Indigestion	719.4	224
Repeat Breeding	3060.7	430
FMD	3165	1640
Diarrhoea	500	166

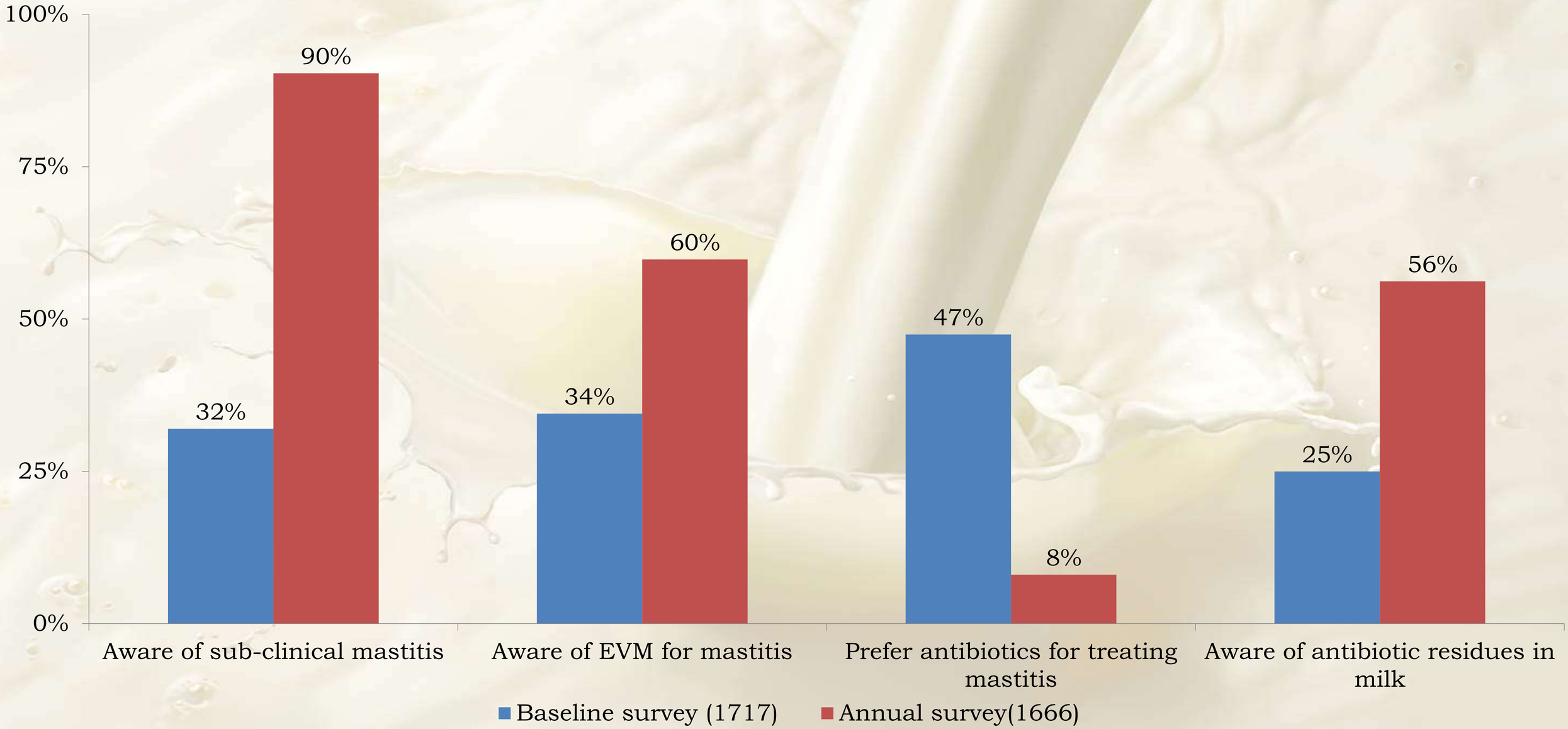
**Nair et al (2022).*



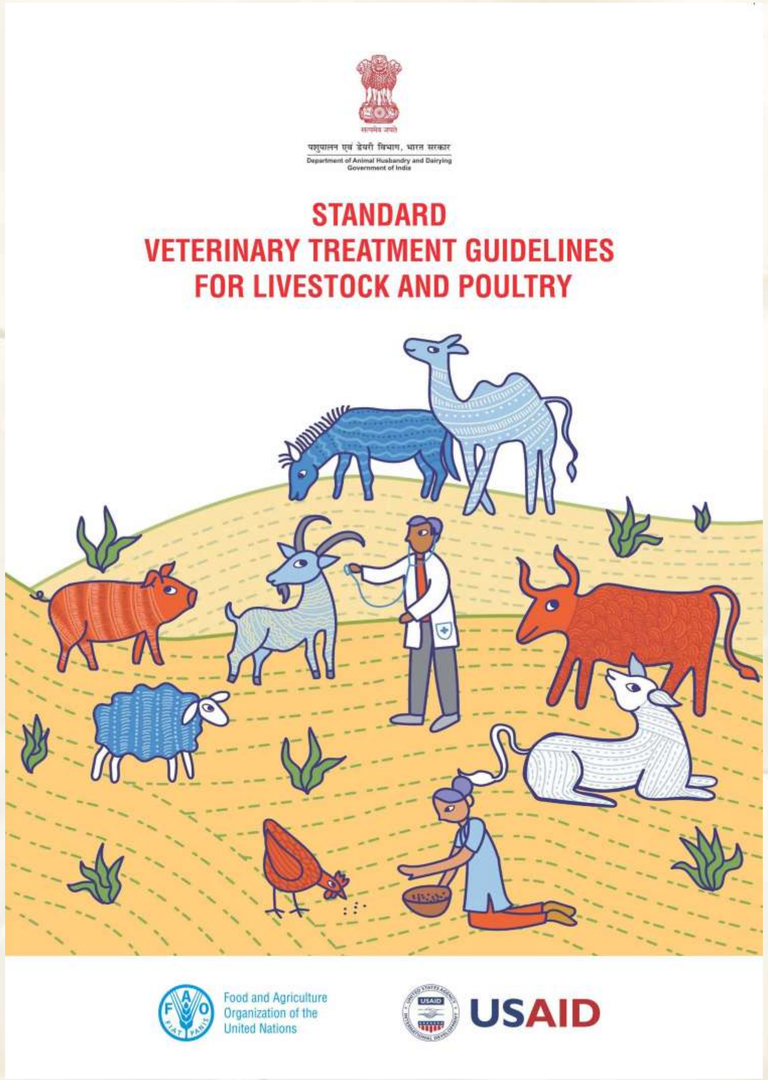
Total savings since 2017-18
Rs.1939.9 Crore

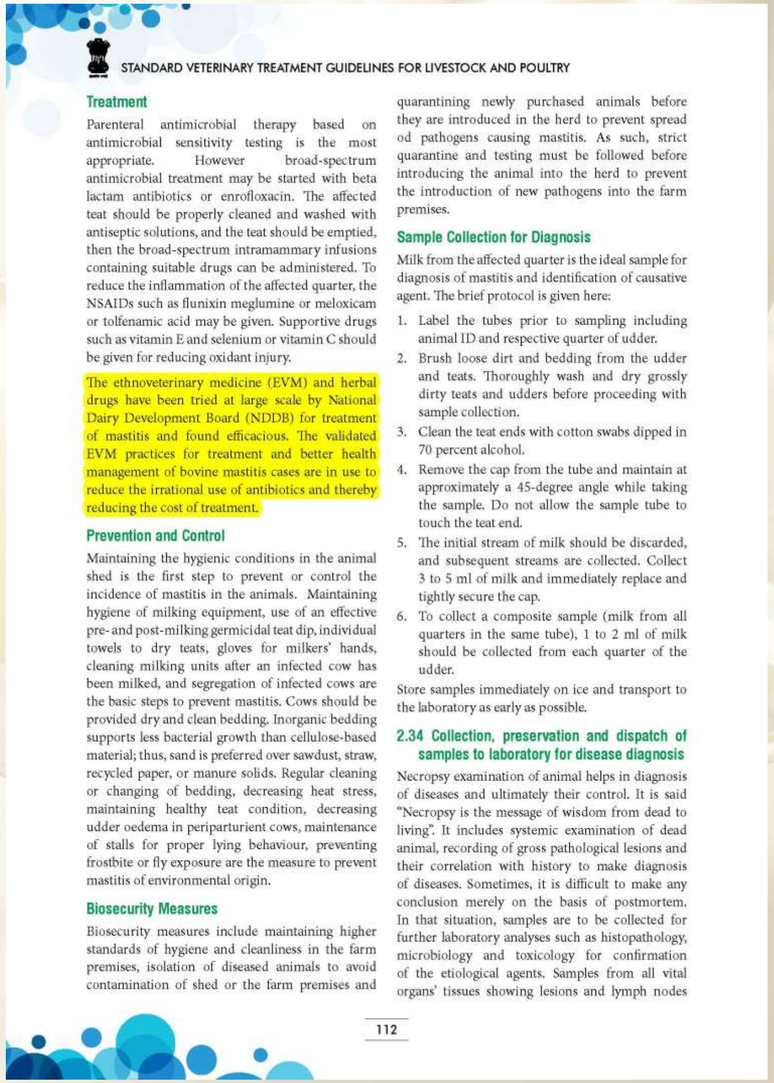
Just for 5 conditions through use of alternative approaches!

Positive change in awareness levels



Government Endorsement





Treatment

Parenteral antimicrobial therapy based on antimicrobial sensitivity testing is the most appropriate. However broad-spectrum antimicrobial treatment may be started with beta lactam antibiotics or enrofloxacin. The affected teat should be properly cleaned and washed with antiseptic solutions, and the teat should be emptied, then the broad-spectrum intramammary infusions containing suitable drugs can be administered. To reduce the inflammation of the affected quarter, the NSAIDs such as flunixin meglumine or meloxicam or tolfenamic acid may be given. Supportive drugs such as vitamin E and selenium or vitamin C should be given for reducing oxidant injury.

The ethnoveterinary medicine (EVM) and herbal drugs have been tried at large scale by National Dairy Development Board (NDDB) for treatment of mastitis and found efficacious. The validated EVM practices for treatment and better health management of bovine mastitis cases are in use to reduce the irrational use of antibiotics and thereby reducing the cost of treatment.

Prevention and Control

Maintaining the hygienic conditions in the animal shed is the first step to prevent or control the incidence of mastitis in the animals. Maintaining hygiene of milking equipment, use of an effective pre- and post-milking germicidal teat dip, individual towels to dry teats, gloves for milkers' hands, cleaning milking units after an infected cow has been milked, and segregation of infected cows are the basic steps to prevent mastitis. Cows should be provided dry and clean bedding. Inorganic bedding supports less bacterial growth than cellulose-based material; thus, sand is preferred over sawdust, straw, recycled paper, or manure solids. Regular cleaning or changing of bedding, decreasing heat stress, maintaining healthy teat condition, decreasing udder oedema in periparturient cows, maintenance of stalls for proper lying behaviour, preventing frostbite or fly exposure are the measure to prevent mastitis of environmental origin.

Biosecurity Measures

Biosecurity measures include maintaining higher standards of hygiene and cleanliness in the farm premises, isolation of diseased animals to avoid contamination of shed or the farm premises and quarantining newly purchased animals before they are introduced in the herd to prevent spread od pathogens causing mastitis. As such, strict quarantine and testing must be followed before introducing the animal into the herd to prevent the introduction of new pathogens into the farm premises.

Sample Collection for Diagnosis

Milk from the affected quarter is the ideal sample for diagnosis of mastitis and identification of causative agent. The brief protocol is given here:

1. Label the tubes prior to sampling including animal ID and respective quarter of udder.
2. Brush loose dirt and bedding from the udder and teats. Thoroughly wash and dry grossly dirty teats and udders before proceeding with sample collection.
3. Clean the teat ends with cotton swabs dipped in 70 percent alcohol.
4. Remove the cap from the tube and maintain at approximately a 45-degree angle while taking the sample. Do not allow the sample tube to touch the teat end.
5. The initial stream of milk should be discarded, and subsequent streams are collected. Collect 3 to 5 ml of milk and immediately replace and tightly secure the cap.
6. To collect a composite sample (milk from all quarters in the same tube), 1 to 2 ml of milk should be collected from each quarter of the udder.

Store samples immediately on ice and transport to the laboratory as early as possible.

2.34 Collection, preservation and dispatch of samples to laboratory for disease diagnosis

Necropsy examination of animal helps in diagnosis of diseases and ultimately their control. It is said "Necropsy is the message of wisdom from dead to living". It includes systemic examination of dead animal, recording of gross pathological lesions and their correlation with history to make diagnosis of diseases. Sometimes, it is difficult to make any conclusion merely on the basis of postmortem. In that situation, samples are to be collected for further laboratory analyses such as histopathology, microbiology and toxicology for confirmation of the etiological agents. Samples from all vital organs' tissues showing lesions and lymph nodes



Additional Readings

ETHNO-VETERINARY FORMULATIONS-1 (dairyknowledge.in)

OIE LIST OF ANTIMICROBIALS OF VETERINARY IMPORTANCE (woah.org)

IITKA_BOOK_TRADITIONAL-KNOWLEDGE-IN-AGRICULTURE-ENGLISH_0_0 (ICAR.ORG.IN)

CARCASS DISPOSAL GUIDELINES-DAHD-GoI

EVM production by Milk Unions/Federations



Banaskantha Milk Union



Sabarkantha Milk Union



Malabar Milk Union



Kaira Milk Union





Punjab Milk Federation

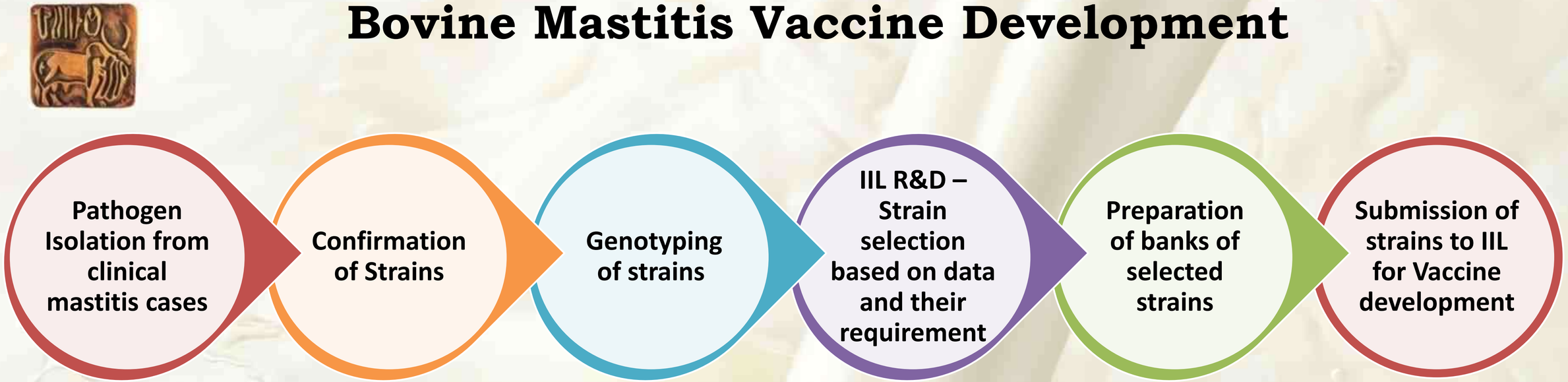


Kolhapur Milk Union

Under construction

- *Jharkhand Milk Federation*
- *Varanasi Milk Union*
- *Pune Milk Union*
- *Mehsana Milk Union*
- *ABC, Salon*

Bovine Mastitis Vaccine Development



- Biochemical &
- Molecular confirmation

Mastitis pathogen

- S. aureus
- S. agalactiae
- E. coli
- Klebsiella sp

- Culture of Strain -5 Nos
  - S. aureus, S. agalactiae, E. coli, Klebsiella sp
- Material Transfer Agreement
- Strain specification information

Support to IIL R&D – on Mastitis Vaccine development

1. Vaccine Banks qualification
2. Re-confirmation of vaccine strains by molecular and biochemical methods
3. Developed Quality control test panel for confirmation of vaccine strain – Submitted to IIL
4. Whole genome sequencing of Vaccine strains of S. aureus, S. agalactiae, E. coli, Klebsiella sp
5. Support in Bacterin Vaccine Efficacy studies in Animal models – SCC determination

Controlling Bovine Brucellosis through a One Health Field Model

Evidence from the Brucellosis Control Programme — Phase I, II & III

2012–2025

Programme span — Phase I, II & III

573+

Villages covered (KNNA + AMUL + SAG)

5 lakh+

Livestock vaccinated

National Dairy Development Board (NDDB) • KNNA • AMUL • SAG

THE INTERVENTION

Four pillars of the field programme

Awareness Creation

Extension via videos, posters, booklets & pamphlets, Documentation of success stories



Vaccination & Surveys

Calfhood vaccinations, ear-tagging, Baseline + annual sero-surveys, Digital recording, SOPs, field-staff training,



Animal Management

Isolation of infected animals, Safe disposal of placenta & aborted foetus, Disinfection of infected premises



One Health Component

Screening of high-risk groups & owners, Village camps, counselling & treatment, Physician awareness building



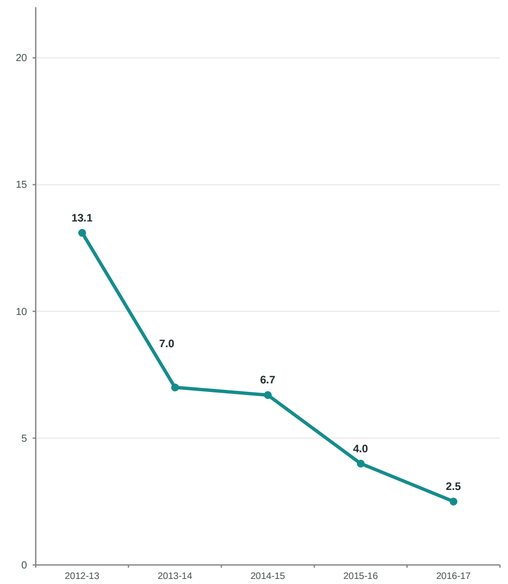
COVERAGE (PHASE II) — Kutch (KNNA): 200 villages | AMUL: 365 villages | SAG: 8 villages | Total: 573 villages

PROGRAMME OUTCOMES — 2012 TO 2025

A 13-year decline in herd sero-prevalence

KNNA — Kutch

Phase I · 132 villages

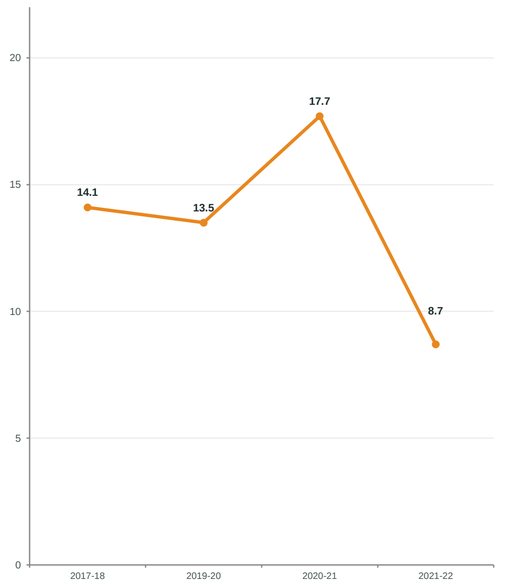


13.1% → 2.5%

−81% relative

AMUL

Phase II · 365 villages

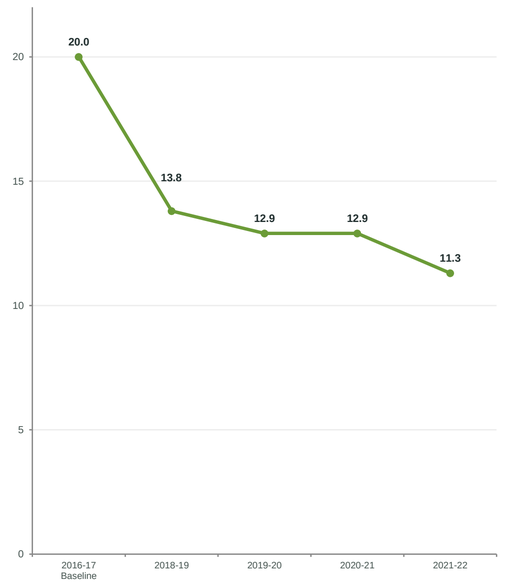


14.1% → 8.7%

−38% relative

KNNA — Kutch

Phase II · 200 villages

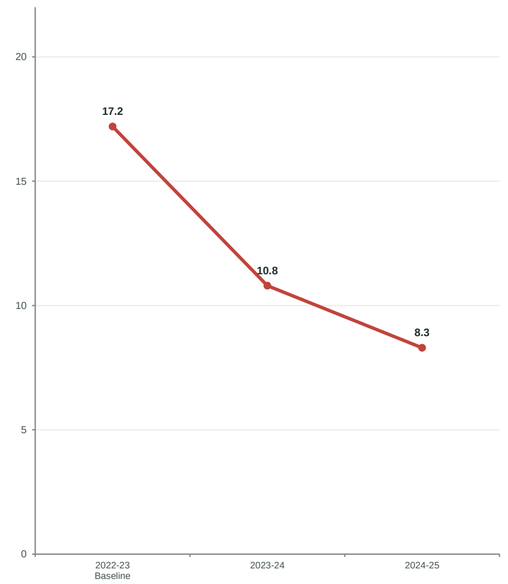


20% → 11.3%

−43% relative

AMUL

Phase III · 100 villages



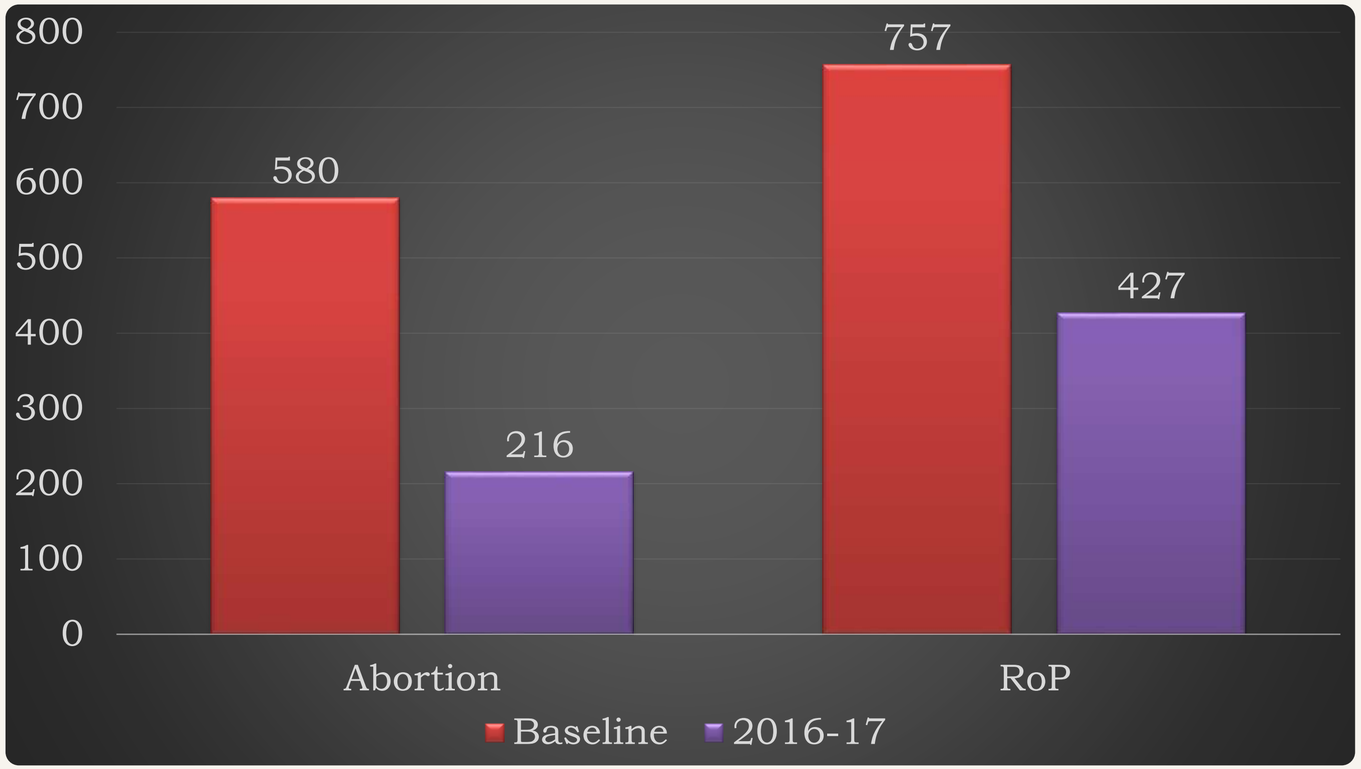
17.2% → 8.3%

−52% relative

Sustained multi-phase surveillance (2012–25) shows sero-prevalence trending down across every implementing partner and cohort tracked to date.

Fewer abortions and retained placenta cases – Phase I

Cases recorded across 132 villages



–63%

Reduction in abortion cases
580 → 216

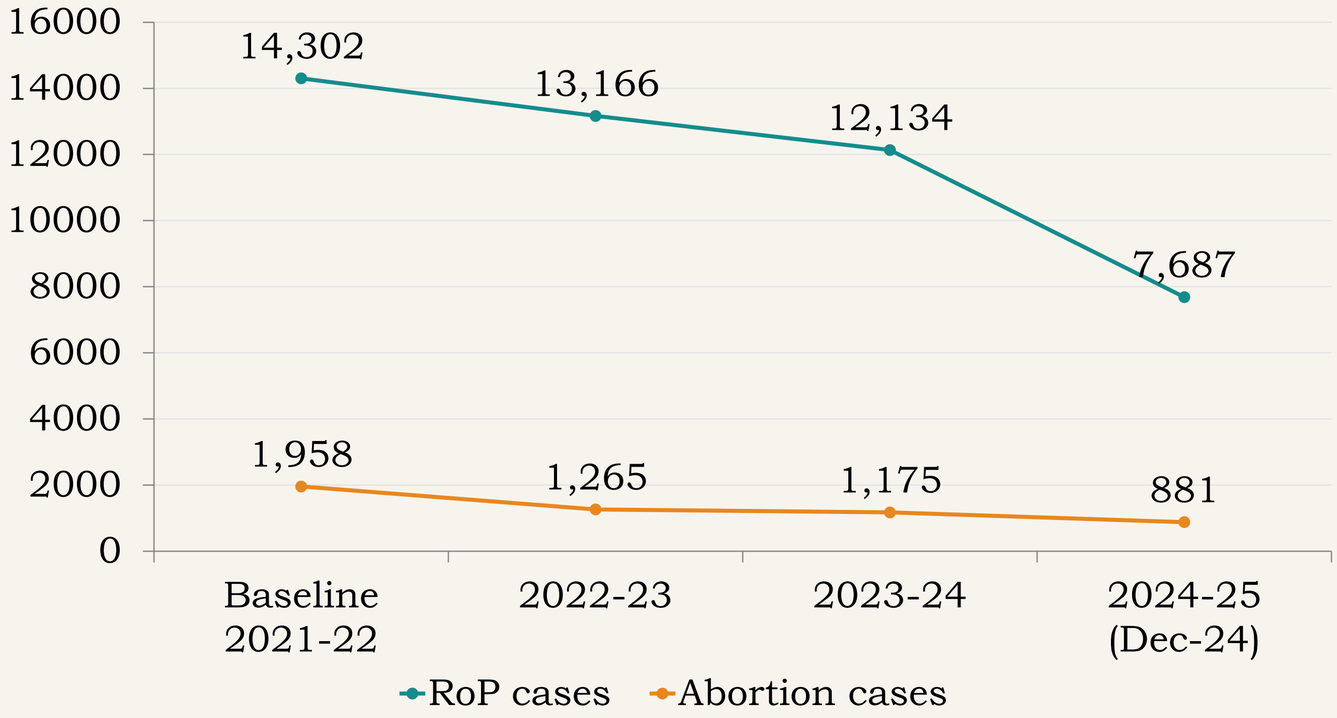
–44%

Reduction in retention of placenta (RoP) cases
757 → 427

PHASE III — 2021–22 TO 2024–25

The decline continues into Phase III

Cases recorded across Phase III project villages



–54%

Reduction in RoP cases
14,302 → 7,687

–45%

Reduction in abortion cases
1,958 → 881

PROGRAMME OUTCOMES

Vaccination at scale — and proof it protects in the field

>5 lakh
calf-hood vaccinations delivered

100%
ear-tagged & recorded in INAPH

322
animals followed up 5 years post-vaccination

Cattle

Samples followed up	171
Abortion cases observed	0
% Sero-positivity	15.7%

Buffalo

Samples followed up	151
Abortion cases observed	1
% Sero-positivity	15.3%

Key insight

Across 5 years of follow-up, only 1 abortion occurred among 322 vaccinated animals — and that buffalo tested negative for brucellosis, confirming strong field protection from calf-hood vaccination.

PROGRAMME OUTCOMES

One Health in practice — awareness turning into safer behaviour

From awareness to safer practice

+39 %

average rise in adoption of safe practices across the three indicators tracked

IRMA study — 240 farmers surveyed across project villages, before vs. after the programme

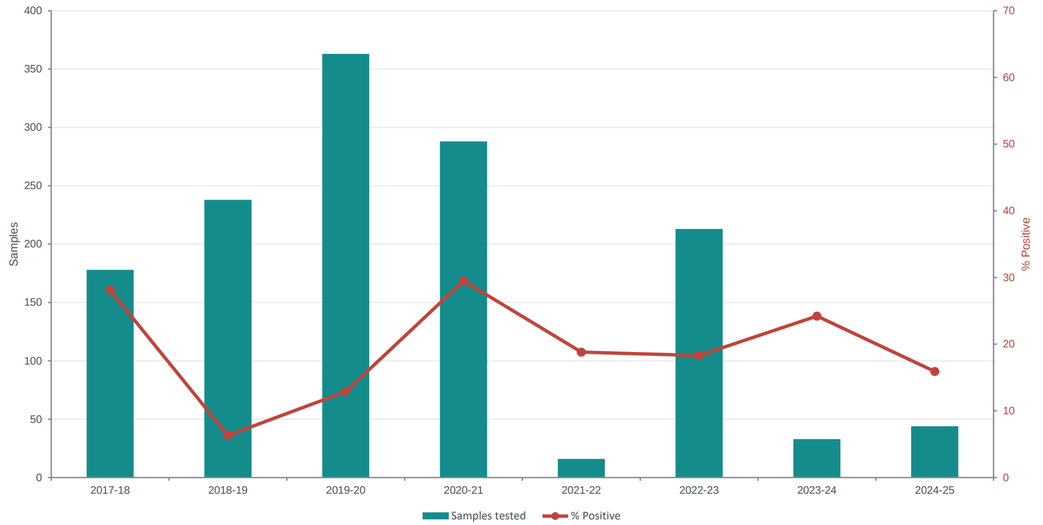
Farmer practice change — before vs. after the programme



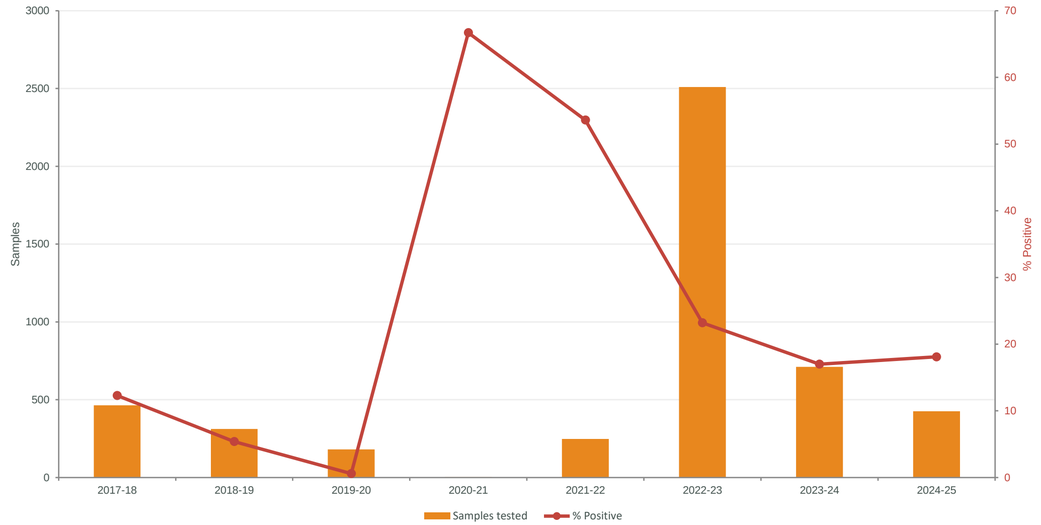
HUMAN SURVEILLANCE (2017–18 TO 2024–25)

Brucellosis testing among vets, paravets & livestock owners

Vets / Paravets tested



Livestock owners tested



1,373

vets/paravets samples — 254 positive (18.5%)

88 / 88

vets/paravets treated & cured

4,854

livestock-owner samples — 990 positive (20.4%)

52 / 52

livestock owners treated & cured

THE ECONOMIC CASE

Every ₹1 spent on treatment returns ₹2.9

Cost-Benefit Analysis of Brucellosis control project — NDDB × Karamsad Hospital study (n=52 beneficiaries)

Overall cost-benefit ratio

2.9x

Average-cost basis, across all beneficiary categories combined

Total benefit (n=52)	**₹15.84 L**
Total cost incurred	**₹5.50 L**
Net benefit generated	**₹10.34 L**

Cost-Benefit Ratio by beneficiary category (₹ return per ₹1 spent)



Direct costs (~40%)

Treatment, diagnostics & alternative-care spend

Indirect costs (~55%)

Lost productivity & household income — the largest cost driver

Intangible costs (~5%)

Mental anxiety & social isolation during illness

Pathogen Screening of Bulk milk from Milk Societies under DISHA

Molecular Screening

S No	Pathogen
1	*Salmonella* Typhimurium
2	*Salmonella* Dublin
3	*Listeria monocytogenes*
4	Shiga toxin 1
5	*Escherichia coli* O157
6	*Campylobacter jejuni*
7	*Mycobacterium tuberculosis*
8	MTC (*Mycobacterium tuberculosis* complex)
9	*Coxiella burnetii*
10	Shiga toxin 2
11	*Chlamydia abortus*
12	*Leptospira*
13	*Staphylococcus aureus*
14	*Escherichia coli*
15	*Klebsiella pneumoniae*
16	*Mycoplasma bovis*
17	*Brucella*
18	*Streptococcus agalactiae*
19	H5N1
20	H1N1
21	BVDV

ELISA & Other methods

Disease
Brucellosis
IBR
Coxiella
Neospora
Chlamydia
Johne's Disease

Heavy Metals
Arsenic
Tin
Cadmium
Mercury
Lead
Copper

Residues
Aflatoxin M1
Tetracycline
Quinolones
Streptomycin
Sulphonamide
Beta-lactam
Pesticides (59)

New entities
Polyfluorinated Alkyl substances
Bisphenol A
Microplastics

Milk unions can evolve from milk collection agencies into One Health surveillance systems

DISHA Project- A multipronged approach





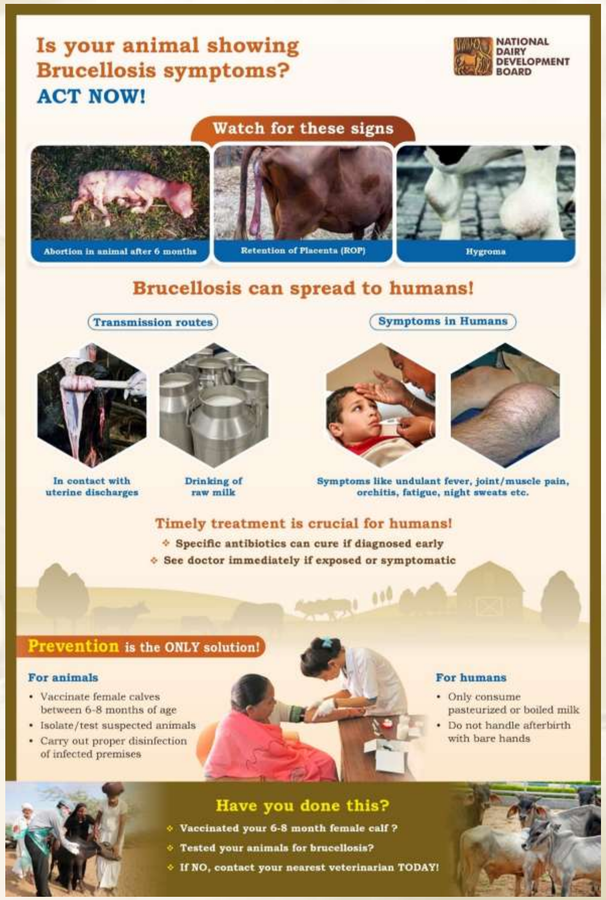




Scalable interventions are possible in One Health!

DISHA Project- contd..









Scalable interventions are possible in One Health!

The Pilot: NDDB-KVASU Hoof Academy

The six training batches from September to January

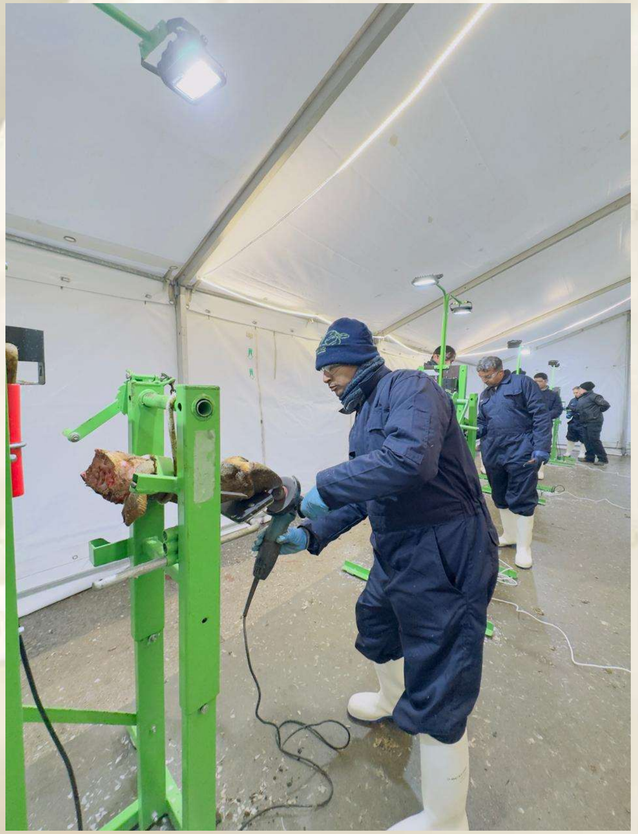
6
batches in the KVASU cascade

10
participants, all veterinarians

6 days
instructor day + main course

6 Batches : KVASU, Thrissur

- Along with the Denmark team, few Indian vets trained at Denmark will also participate in refresher training
- Faculty: Prof. Nynne Capion (University of Copenhagen) and Ms. Anette , on site (2 batches) and video support for the rest
- Vets from refresher training will also assist them
  - This will make the faculty for the subsequent batches
- Total 6 batches, 60 participants



Hands-on WLAM trimming practice during the Denmark study tour: the trainees will practise on cadaver feet





Sole Haemorrhage



Toe haemorrhage



White line disease



Sole Ulcers



Interdigital Hyperplasia



Double sole



Collaborations and Partnerships

Government

A-HELP programme

Industry

MUs, PCs and other private entities

MUs & PCs

Milk Unions (MU) & Producer Companies (PC)

Civil Society

DCSs,SHGs,FPOs, Pashusakhis

Research

Universities, IISc & private research labs;




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Bhaikaka University
Instilling Purpose in Healthcare
Charutar Arogya Mandal, Karamsad


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हेल्दी माईंड, हेल्दी लाईफ !






Saahaj


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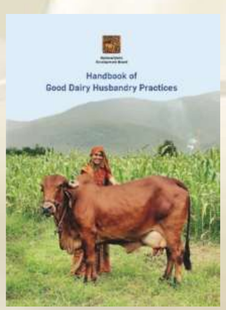






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