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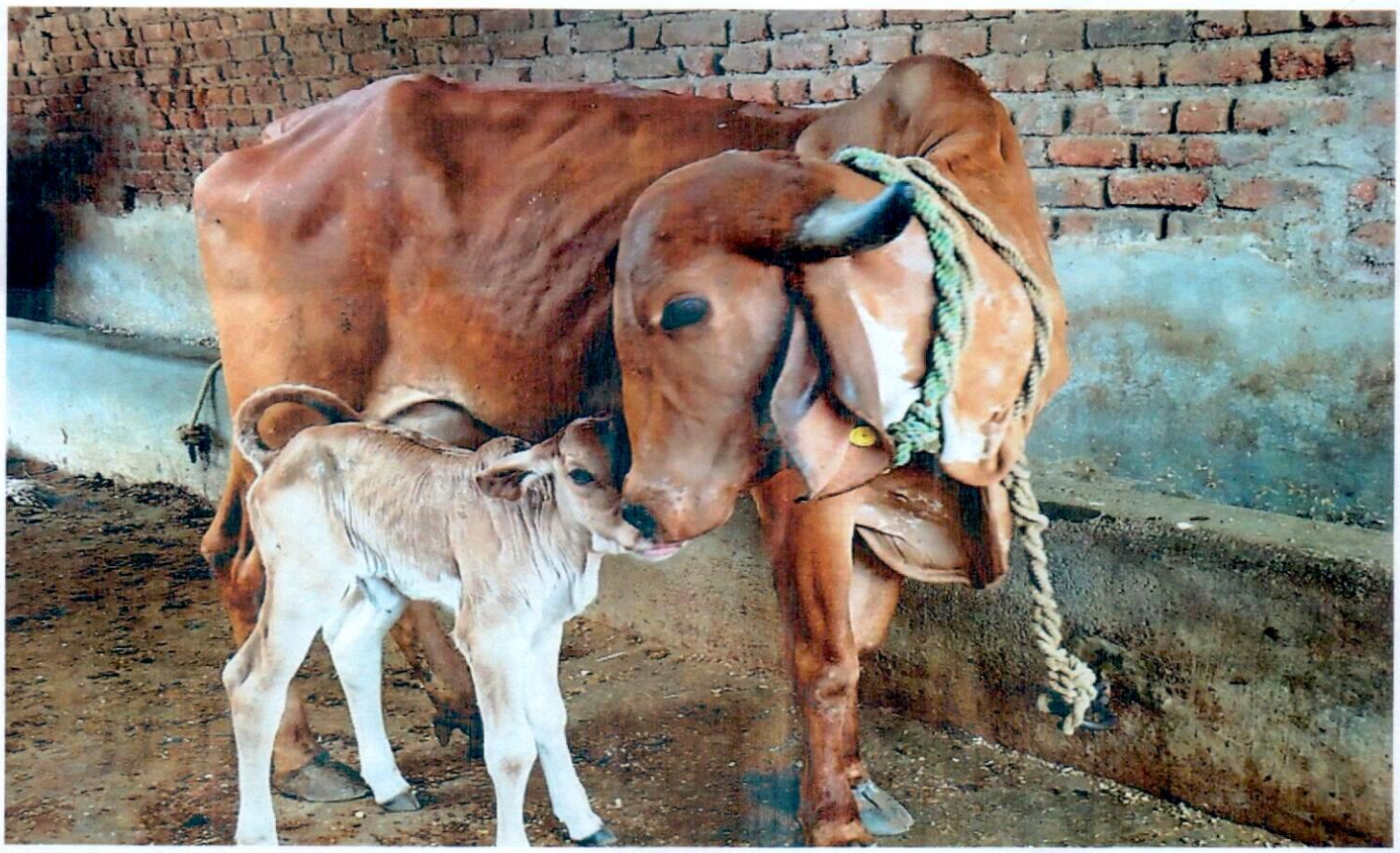
STRATEGY DOCUMENT ON THE PREVENTION AND CONTROL OF MASTITIS



Ministry of Fisheries, Animal Husbandry and Dairying

Department of Animal Husbandry and Dairying,

Government of India

Abbreviations Used

A-HELP	Accredited Agent for Health and Extension of Livestock Production
AMR	Antimicrobial Resistance
ASCAD	Assistance to States for Control of Animal Diseases
BCS	Body Condition Score
CMT	California Mastitis Test
CST	Culture and sensitivity tests
DCT	Dry Cow Therapy
EVM	Ethnoveterinary Medicine
GLP	Good Laboratory Practice
GRASS	Generally Recognized as Safe
KVKs	Krishi Vigyan Kendras
LH&DCP	Livestock Health & Disease Control Programme
MVUs	Mobile Veterinary Units
NGOs	Non Governmental Organizations
SCC	Somatic Cell Count
SCM	Subclinical Mastitis
SDCT	Selective Dry Cow Therapy
SQT	Selective Quarter Therapy
TSC	Tri-Sodium Citrate

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Disclaimer

This strategy document has been prepared by the Department of Animal Husbandry and Dairying (DAHD), Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, based on consultations with subject experts, institutions, and stakeholders. The information, recommendations, and practices outlined herein are intended to serve as broad guidance for stakeholders involved in mastitis prevention and management in dairy animals. While every effort has been made to ensure accuracy and relevance, the Department shall not be held responsible for any unintended errors, omissions, or consequences arising from the implementation of the strategies. Users are encouraged to consult qualified veterinary professionals and adapt practices as per local conditions and emerging evidence.

Strategy Document on the Prevention and Control of Mastitis

1. Introduction

Bovine mastitis is a common and economically significant disease affecting milch animal worldwide. It is an inflammatory condition of the udder tissue, primarily caused by bacterial, fungal, or viral infections, though physical and chemical injuries may also contribute. Mastitis remains a key issue in dairy farming, primarily due to its significant effects on milk production, quality, and animal health. It results in economic burdens through loss of milk, increased treatment costs, and premature culling.

The condition can manifest in clinical and subclinical forms, with the latter being particularly challenging to detect and manage.

I. **Clinical Mastitis:** Visible changes in udder (swelling, heat, pain) and milk (colour, blood, fibrin) with a sharp drop in milk yield

II. **Subclinical Mastitis:** No visible changes, only detected by diagnostic tests
Subclinical mastitis is more important worldwide including India (varying from 10- 50% in cows and 5-20% in buffaloes) than clinical mastitis (1-10%).

Clinical and subclinical mastitis are the costliest diseases in dairy farming, with global annual losses estimated at approximately US$13 billion and US$9 billion, respectively. Given the substantial economic burden, effective prevention, early diagnosis, and treatment are essential for controlling mastitis, ensuring animal welfare, and sustaining dairy productivity.

To address these challenges, a multi-dimensional strategy that emphasizes prevention, management, and farmer education is critical for effective control. This document will explore a holistic strategy that focuses on hygiene practices, balanced nutrition, and efficient management techniques for reducing mastitis in dairy herds across India.

2. Factors contributing to Mastitis

2.1. Pathogen Factors: Mastitis is often triggered by pathogens that can be broadly classified as **contagious** or **environmental**.

- **Contagious Pathogens:** These pathogens, such as *Staphylococcus aureus* and *Streptococcus agalactiae*, are typically spread from cow to cow during milking. Poor milking hygiene, such as using shared milking equipment without proper sanitation, is a major contributor.
- **Environmental Pathogens:** These include organisms like *Escherichia coli* that thrive in manure, bedding, and unclean housing environments. Improper housing management, such as infrequent manure removal and poor ventilation, allows these pathogens to proliferate and infect cows.
- **Other Pathogens and Causes:** Mycoplasma, fungi, virus, trauma, chemical irritant, etc.

2.2. Host Factors:

- **Susceptibility by Species, Breed and Genetics:** Crossbred cows, which are bred for high milk production, are more prone to mastitis compared to indigenous breeds. Native breeds often have a comparatively strong natural resistance for intramammary infection as compared to cross bred cattle. Buffaloes and goats, too have less prevalence but susceptible for this infection.
- **Age, Parity and Stage of Lactation:**

    1) The prevalence of mastitis is directly related to the increasing age and parity. Older cows are more susceptible to mastitis, because of the wider or permanently partially open teat canal as a result of frequent milking, and older cow mammary epithelium increases the permeability due to previous infection.
    2) The increased risk of intra-mammary infection (IMI) probably because teat canals lengthen and dilate with increase in lactational age. Moreover, multiparous cows are more vulnerable to mastitis than primiparous cows due to immune incompetence.

3) Stage of lactation:Cows are most susceptible to mastitis around the time of calving, during the transition period. The stress of calving, along with physiological changes in the udder and immune suppression during this period, make them vulnerable to infections.
4) Nutrients and immune system: In lactating animals, there is a higher demand of energy and nutrient during lactation period for the synthesis of colostrum and milk. Inadequate supplementation of nutrients (e.g. trace elements, amino acids, vitamins etc.) may lead to immunosuppression during transition period or onset of lactation, and thus consequently increasing susceptibility to mastitis.

2.3. Environmental factors:

Environmental factors are also equally important, and their effective management can significantly support in the prevention and control of mastitis. Numerous environmental conditions and dairy practices may serve to render the udder more susceptible to infection by bacterial agents. The two important factors of heat stress namely temperature(heat) and humidity are directly responsible for the occurrence of mastitis. Housing of animals is positively associated with an increase in new cases of mastitis.

3. Mastitis: A Silent Drain on Milk Quality and Dairy Economics

Mastitis remains one of the most economically damaging diseases affecting dairy herds. Beyond compromising milk quality, it imposes heavy financial losses on farmers. For instance, a high-yielding cow suffering from mastitis may experience a reduction of 3–4 kg in daily milk yield—resulting in a daily income loss ranging from ₹306 to ₹458 per animal[2]. Additionally, the need to discard milk during the treatment period leads to further losses of approximately ₹150–₹200 per cow.

However, the true economic burden extends beyond milk loss. Farmers often bear higher costs due to missed market opportunities, expenses for veterinary care, labor, and in some cases, premature replacement of affected animals.

In the Indian context, the annual economic loss attributed to mastitis is estimated at Rs. 2370 crore with subclinical mastitis—often undetected due to the absence of overt symptoms—accounting for nearly 70% of this total. This underscores an urgent need for proactive and sustained mastitis management interventions to protect both herd health and farm incomes[3].

Major Economic Impact Areas:

- **Milk Disposal:** Milk from clinically affected cows cannot be sold or processed, resulting in direct income loss.
- **Reduced Milk Yield:** Subclinical mastitis leads to a gradual but sustained decline in milk production, often going unnoticed until losses accumulate significantly.
- **Deteriorated Milk Quality:** Even in the absence of clinical signs, mastitis reduces vital milk components such as lactose, fat, casein, and solids-not-fat (SNF), negatively affecting product value and consumer trust.
- **Veterinary and Management Expenses:** Ongoing costs related to diagnosis, treatment, veterinary services, and extra labor increase the economic burden on dairy operations.
- **Premature Culling and Replacement:** Animals that fail to respond to treatment may need to be culled earlier than planned, leading to the added cost of sourcing and raising replacements.

4. Challenges in Mastitis Management

Managing mastitis is complicated due to:

- **Diverse Pathogens:** A wide range (>137) of microorganisms including bacteria, fungi, yeast, virus etc. are responsible for causing mastitis, as a result, managing the disease becomes difficult. Moreover, resistance of pathogens against commonly antibiotics and blind therapeutic approaches are the other challenges in this direction.
- **Antimicrobial Resistance (AMR):** The over and/or indiscriminate use of antibiotics has led to increased cases of antimicrobial resistance, making treatment less effective over time. The more frequently antibiotics are used without proper guidance, the higher the risk of resistance.

- **Detection Challenges:** Delay in the diagnosis of mastitis especially subclinical mastitis, since clinical mastitis causes visible changes in the milk and udder, which is easily noticed by the farmers. Subclinical mastitis can persist unnoticed for a long time without routine testing (such as CMT, SCC), meaning the infection continues to affect milk quality and production without the notice of farmers.
- **Lack of awareness:** Mastitis is managemental disease, which severely affect the production and causes very high economic losses due to lack of awareness among dairy farmers about basic knowledge of this disease.

5. Mastitis Control Strategies: A Holistic Approach

The strategy for the prevention and control mastitis should be effective, holistic and comprehensive. Mastitis may be included by the States/UTs for support under Assistance to States for Control of Animal Diseases (ASCAD) component of Livestock Health & Disease Control Programme (LH&DCP) for effective control at all levels to improve the milk quality and reduce economic losses to the dairy farmers.

5.1. Hygiene Practices: Implementing stringent hygiene practices during milking is the cornerstone of mastitis prevention:

- **Udder and Teat Preparation**: Udder and teat, before milking should properly be cleaned with clean water using jet spray or pipe and wiped with clean cotton cloth or paper towel to ensure that dirt is not introduced into the milking system.

  Adopting the pre-milking hygiene standardization methods, such as manual fore stripping (gently removing the first three to four streams of milk from each teat before the milking is carried out) is necessary to maintain udder health.

  Promote Full Hand Milking: "To promote udder health, it is recommended to encourage the adoption of full hand milking (where the entire hand is used to gently squeeze the udder or teat of the animal) as a standard practice."

- **Pre-Milking & Post-Milking Teat Dipping:** To prevent the introduction of dirt and bacteria into the milk system, make sure the teats are cleaned and dried before milking. Iodine- or chlorhexidine-containing teat dips create a barrier to keep infections out of the teat before, during, and after milking. The animals should not be allowed to sit down for at least 40-45 minutes so that teat orifice is closed properly.
- Ensure that the pre-milking teat disinfectant has a minimum contact time of at least 30 seconds before being removed.
- **Equipment Sanitation:** Milking machines and equipment should be thoroughly cleaned and sanitized after each use to prevent the spread of contagious pathogens between animals.
- "Before and after milking, properly wash and sun-dry all vessels to prevent contamination and maintain cleanliness. After each milking, thoroughly clean and disinfect the milking machine, teat cups, and all vessels used during the milking process. Dairy farmers should adhere to all other best practices for hygiene recommended by the Food Safety and Standards Authority of India(FSSAI).
- **Personal Hygiene:** The milkman should strictly follow proper hand hygiene by keeping the nails properly trimmed and by washing hands with soap and water, followed by using a hand sanitizer before and after each milking.

Actionable Points: A dairy cooperative can establish farmer field schools to demonstrate best practices, including proper teat cleaning and dipping, effective operation and maintenance of milking machines, and hygienic housing layouts. Additionally, milkers should be sensitized to these practices, with milk producers actively monitoring compliance to ensure clean milk production.

5.2. Housing Management: The environment where cows are housed has a significant impact on the incidence of mastitis:

- **Clean and Dry Floor and Bedding:** Cows should be housed on clean, dry floor and bedding that is changed regularly. Wet and dirty bedding harbors environmental pathogens.
- **Ventilation:** Dairy farm should have proper ventilation to reduce the animal stress and increase productivity. Proper airflow reduces moisture and the proliferation of bacteria in barns, especially in hot and humid conditions.

- Heat stress management particularly for cross-bred cows is of utmost importance during extreme summer as it directly impacts milk production. This can be achieved using shower and fans
- Extreme cold conditions and hilly terrains increase the risk of mastitis due to cold stress and exposure; providing insulated shelters, adequate bedding, and ensuring proper udder care can help mitigate risks.

Actionable Points: Smallholder dairy farms could receive support for affordable bedding solutions, such as the use of sand or other absorbent materials or rubber mats, and training on how to set up adequate ventilation in local climatic conditions

5.3. Regular Monitoring and Early Detection:

- **General Monitoring:** Regularly check for signs of mastitis like swollen udders, redness, abnormal milk consistency, or changes in milk let-down. Practice for milking to visually inspect the first few streams of milk for clots or abnormalities.
- **Somatic Cell Count (SCC) Testing:** Regular SCC testing should be adopted as a standard practice to detect subclinical mastitis. An SCC of 200,000 cells/mL or higher indicates infection, even when no outward symptoms are visible. Bulk Tank Milk SCC is the best indicator of a herd udder health. An automatic somatic cell counter i.e. Fossomatic automatic cell counter will support in detection of mastitis.
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- Indian breeds, especially buffaloes, have a lower SCC profile that exotic breeds.
- **Community Initiatives:** These initiatives can involve grassroots animal health workers, community workers, para-vets visiting farms to educate and assist farmers in performing regular checks, such as the California Mastitis Test (CMT; For details Please see **Annexure I**).
- **Mobile Veterinary Units (MVUs):** These units maybe equipped with diagnostic kits like CMT to offer affordable, accessible testing in remote areas.

Actionable Points: Setting up a program to monitor milk quality at collection centers could incentivize farmers to adopt best practices and regularly test their herds for mastitis.

5.4. Balanced Nutrition and Transition Period Management:

- **Nutritional Support:** High-yielding cows need diets rich in energy, vitamins, and minerals, particularly during the transition period. Special attention should be given to maintaining calcium and phosphorus balance with the anionic diet to support udder health. Preference should be given to provide transition feed during transition period (- 21 days to + 21 days of calving).
- To address the energy, protein, and mineral deficiencies in cattle, use a balanced feed made from local ingredients, with mixtures, Mineral Block, along mineral Urea Molasses tri-sodium citrate, urea-treated straw, and green fodder. Vitamin grade) Giving E (feed 30 days before and 60 days after calving helps boost immunity.
- "Ensure access to daily unlimited supply of drinking water for cattle at all times, including before and after milking, in a manner that encourages access."
- **Stress Management:** Conditions like metritis, laminitis and poor uterine health are also known contributors to the development of mastitis in cattle. Minimizing stress through comfortable calving spaces, restricted movement after calving, and proper nutrition helps lower the risk of mastitis.
- To reduce udder stress, a regular milking routine should be followed (twice or thrice a day) in a gentle and rapid wayTo reduce udder stress, a regular milking routine should be followed (twice or thrice a day) in a gentle and rapid way.

Actionable Points: Collaborating with local veterinary services and extension agencies to offer tailored feeding plans for high-risk cows, especially during the transition period. The farmers should be made aware about the regular use of area-specific mineral mixtures so that immunity is maintained in the animals to fight against pathogens.

5.5. Antibiotic Stewardship and AMR Control:

- **Targeted Use of Antibiotics:** Antibiotics should only be used based on culture and sensitivity tests (CST)to ensure the right drug is selected for the specific pathogen. This reduces unnecessary use of broad-spectrum antibiotics.

- Withdrawal periods for milk following Dry Cow Therapy(DCT), which product-specific, should be threshold are per as recommended by the Central Drugs Standard Control Organization, and relevant accurate record-keeping encouraged.
- **Promotion of Ethno-Veterinary Practices:** Incorporating natural remedies such as turmeric, garlic, and aloe vera for mild cases can reduce the reliance on antibiotics, especially in subclinical infections. Farmers may register in the 1962 Bharat Pashudhan app for details of ethno-veterinary practices
- **Avoiding Over-the-Counter Antibiotics:** Educating farmers and veterinary professionals about the importance of prescribing antibiotics only by trained personnel to avoid misuse or overuse.
- **Surveillance and Antibiotic Stewardship:** Regular and continuous screening of milk samples for culture and antibiotic sensitivity should be conducted to enable zone-wise mapping of antimicrobial resistance patterns, supporting effective antibiotic stewardship.

Actionable points: Farmer training programs can include demonstrations on using herbal preparations for mastitis treatment, along with the appropriate methods of administration. Additionally, awareness campaigns can highlight the importance of adhering to withdrawal periods after antibiotic use to ensure milk safety and compliance with food safety standards. Establishing a state-level centralized Mastitis Control and AMR Monitoring Laboratory is also recommended. Furthermore, regional and district-level laboratories may be equipped with facilities for Culture and Sensitivity Testing (CST) and AMR surveillance to enhance diagnostic and reporting capabilities across the network.

Dairy cooperatives could educate farmers on handling dairy animals with care and to avoid all forms of stress and agitation in dairy animals before milking for increased milk yield and to reduce the incidence of mastitis.

5.6. Education and Awareness Campaigns: Educating farmers on best practices is crucial for long-term prevention:

- **Awareness and Education Campaign:** Professional Milkers, AI technicians, milk recorders, and supervisors may be educated about the importance of Clean Milk Production

and best hygienic practices. Under the National Program for Dairy Development, training on Clean Milk Production and improved hygiene practices is being provided to farmers.

- **Post milking feeding:** Promote the feeding of green fodder after milking to avoid immediate sitting of animals on the contaminated floor. Teat orifice remains open after milking upto one hour.
- **Prompt Reporting**: Milk recorders and AI technicians who observe any abnormal health events or signs of mastitis in their operational areas should promptly report these observations to the designated or government-appointed Animal Health Officer.
- **Milking Hygiene and Equipment Maintenance:** Regular training should be provided to farmers on cleaning milking equipment, teat dipping, and proper udder care.
- **AMR Awareness:** Campaigns should emphasize the importance of avoiding unnecessary antibiotics and the risks of residues in milk.
- **Milk Sample Collection for Culture and Sensitivity Testing**: Farmers should be trained about how to collect milk samples for CST as it is an important step to get true results.
- **Peer Learning Sessions:** Organizing peer learning sessions where experienced farmers share their practices and success stories in mastitis prevention with others in their community.

Actionable Points: Partnering with dairy cooperatives and veterinary schools to develop farmer-focused materials (pamphlets, videos) that explain mastitis prevention and the importance of monitoring

5.7. Biosecurity Measures:

- **Pasteurization:** To prevent the transmission of mastitis pathogens through milk, strict protocols should be in place to ensure milk is pasteurized before consumption.
- **Segregation:** Cows with chronic, untreatable mastitis should be segregated to prevent the disease from spreading to healthy animals.
- **Milking Order:** Healthy cows should be milked first then affected ones.
- **Milking pattern of infected animals:** Infected quarters/animals should be milked in the last to avoid transmission of contagious pathogens.

- Dairy farmers are encouraged to create designated spaces for quarantine of new animals before their introduction in the herd.

Actionable Points: Developing a biosecurity protocol in collaboration with milk processing units to ensure that all milk sold meets safety standards. Additionally, provide training to farm workers on implementing and adhering to biosecurity measures effectively.

5.8. Breeding Program: Selecting animals that show resistance to mastitis can significantly improve herd health. Genetic selection focuses on traits like:

- **Breeding programs**: Implement selective breeding programs in Progeny Testing programs focusing on traits associated with mastitis resistance, such as udder conformation, somatic cell count and milk composition. Mastitis resistance traits, including Somatic Cell Score, should be integrated into the Genomic selection criteria for bulls along with major production traits.
- Besides the progeny and pedigree tests, a composite health analysis of factors such as calf survival, fertility index, somatic cell count, mastitis, lameness and calving ease (direct and maternal) could also considered be for breeding programs.
- **Udder and Teat Conformation:** Animals with better udder and teat structure are less prone to injury and infection.
- **Health and Longevity:** Breeding programs should aim to balance production traits with traits that enhance health and resistance to diseases like mastitis.

Actionable points: In the future, Dairy cooperatives may promote farmers to use semen from bulls with proven resistance to mastitis, promoting genetic improvement within local herds. Further, cooperatives could organize awareness programs on the advantages of genetic selection for mastitis resistance.

5.9. Dry Cow Therapy: The dry period is a critical time in the management of dairy cows, as it plays a vital role in maintaining udder health and preventing mastitis in the subsequent lactation. Effective management during this phase is essential to reduce the incidence of both clinical and subclinical mastitis, which often develops during this period. By implementing these management practices during the dry period, dairy farmers can significantly reduce the incidence of mastitis in

their herds, leading to healthier cows, improved milk production, and reduced reliance on antibiotics (For details please see **Annexure II**)

5.10. Research and Development:

- **Vaccine development:** There is urgent need of development of indigenous vaccine by including maximum number of highly prevalent mastitis causing bacteria. However, success rate of vaccine is also a challenge due to multi-etiological nature of the disease.
- **Alternative to Antimicrobials:** With growing concerns over antimicrobial resistance (AMR), there is an urgent need to explore alternative approaches to manage bovine mastitis effectively. Research is focusing on non-antimicrobial strategies such as the use of immunomodulators, probiotics, and bacteriophages to enhance the natural defense mechanisms of dairy cattle.
- **Precision Farming & Sensors:** Additionally, the application of precision farming technologies, including automated sensors for early detection and monitoring of udder health, enables timely interventions that reduce reliance on antimicrobials.

Actionable Points: Efforts to develop an indigenous mastitis vaccine targeting a broad range of prevalent bacteria through collaboration between research institutions, universities, and the private sector. Explore non-antimicrobial alternatives like immunomodulators and probiotics, while promoting precision farming technologies, such as automated sensors, for early detection and reduced reliance on antimicrobials.

For milking, equipment machine ensure is well-maintained, correctly sized, and fitted with mastitis detectors. Adjust machines to avoid backflow, harsh vacuum, or uneven pressure. Use protective covers and auto-removal systems to protect udder health. Allow 60–90 seconds between preparation cluster teat and attachment and minimize machine-on time.

5.11. Monitoring and Evaluation: Effective mastitis control requires ongoing monitoring and evaluation:

- **Data Collection:** SCC levels, treatment outcomes, antibiotic use, and culling rates should be recorded regularly.

- **AMR Surveillance:** Surveillance of antimicrobial resistance patterns helps refine treatment protocols and guides antibiotic usage.

Actionable Points: Establishing a centralized database that records mastitis incidents and SCC data from farms across the region will allow for targeted interventions and policy decisions. KVKs and regional centers can be assigned to collect data from the field and report to the central agency.

Conclusion:

By adopting a holistic strategy focusing on hygiene practices, balanced nutrition, responsible use of antibiotics, and continuous farmer education, it is possible to significantly reduce the incidence of mastitis in dairy herds across India. The suggested interventions outlined in **Section 2.3.3** of the Standard Veterinary Treatment Guidelines for Livestock and Poultry may be referred to for specific treatment protocols and management practices. When implemented alongside regular monitoring and evaluation, these measures will help enhance dairy productivity, promote animal welfare, and improve economic outcomes for farmers.

Annexure-I

Distribution of CMT Kits and Farmer Training for Regular Use

Importance of Regular Monitoring for Early Detection

Early detection of subclinical mastitis is crucial for controlling the disease before it escalates into clinical mastitis, which can result in significant milk losses, higher veterinary costs, and premature culling of animals. Since subclinical mastitis is asymptomatic, testing milk samples from cows is one of the most effective ways to detect infections early.

The **California Mastitis Test (CMT)** is a simple, affordable, and effective tool that can be used on farms to identify mastitis in its early stages by detecting measuring somatic cell counts (SCC) in milk samples. Widespread use of CMT by farmers offers several advantages:

- **Early Intervention:** Detecting mastitis early reduces the severity of the infection, minimizing milk losses and treatment costs.
- **Cost-Effective:** CMT is relatively inexpensive, making it accessible even for smallholder dairy farmers.
- **Ease of Use:** The CMT test requires no specialized equipment, only basic training, and can be applied by farmers themselves with minimal effort.

Composition of the CMT Kit

The California Mastitis Test (CMT) solution typically consists of the following:

1. **Detergent**: Sodium lauryl sulfate or a similar surfactant, which lyses somatic cells present in milk.
2. **pH Indicator**: Bromothymol blue or a similar dye that changes color based on the milk's pH, indicating cell count levels.
3. **Water**: Acts as the solvent for the detergent and dye.

This mixture is designed to react with somatic cells (white blood cells) in milk, forming a gel-like substance proportional to the cell count, which provides a visual indication of inflammation levels in the udder.

Distribution of CMT Kits

To ensure that farmers can regularly monitor their dairy herds, the distribution of CMT kits must be prioritized at the grassroots level. Key strategies for distribution include:

1. **Integration into Government Schemes:**
    - CMT kits should be included in government-led animal health initiatives and animal husbandry programs. The Mobile Veterinary Units (MVUs) and A-HELP workers can be equipped with CMT kits to distribute to farmers during routine visits. These kits can also be made available at subsidized rates or for free through government schemes aimed at improving animal health and productivity.
    - Tri-Sodium Citrate (TSC): 100 gm packets of TSC, with a 10g dispenser, should be included in the regimen. Administering TSC orally, either in feed or water, once daily for 10 days can resolve most cases of subclinical mastitis (SCM). TSC is also classified as a GRASS (Generally Recognized as Safe) substance.
    - Providing farmers with cost-effective solutions for controlling SCM will, in turn, help reduce the incidence of clinical mastitis.
    - All milk products should be validated through NDDB, and laboratories must be Good Laboratory Practice (GLP) compliant. ICAR should take the necessary initiative to enable GLP Laboratories.
2. **Partnering with Dairy Cooperatives and KVKs:**
3. Dairy cooperatives can play a key role in facilitating access to CMT kits and Tri-Sodium Citrate (TSC) for their member farmers. **Collaboration with NGOs:**
4. **Inclusion in Veterinary Service Packages:**
    - Veterinary clinics and local animal health workers can offer CMT kits as part of service packages to farmers. This can be accompanied by routine check-ups where CMT tests are performed, encouraging the adoption of regular mastitis screening.

5. **Availability of CMT kits on KVKs/ Regional Centers**: The kits should be made available at all the KVKs and regional centers of the country.

Training Farmers to Use CMT Regularly

Effective mastitis prevention depends on farmers being able to use CMT kits consistently and correctly. A large-scale farmer education program should be rolled out across dairy regions to ensure farmers understand the importance of regular testing and know how to administer the CMT test properly. Key components of this program include:

1. **On-Farm Demonstrations:**
    - Regular **on-farm training sessions** can be organized by **extension officers**, **veterinary services**, and **A-HELP workers** to demonstrate the step-by-step process of conducting the CMT. These hands-on sessions should focus on:
        - How to properly collect milk samples from each quarter of the udder.
        - How to mix the reagent with the milk and read the test results.
        - How to interpret the results and decide on next steps (e.g., treatment or veterinary consultation).
2. **Train-the-Trainer Programs:**
    - KVKs, Dairy cooperatives and local veterinary staff can take initiatives to create Trainers within the community through a **"train-the-trainer" approach**, where selected farmers, veterinarians, and cooperative leaders receive intensive training on CMT testing and then pass this knowledge to fellow farmers. This approach ensures widespread dissemination of knowledge, especially in remote areas.
3. **Incorporating CMT into Milk Collection Centers:**
    - At local **milk collection centers**, trained staff can demonstrate the CMT procedure when farmers bring in milk for testing. This serves as an opportunity to educate farmers on how regular monitoring improves milk quality, which can translate into better market prices and reduced losses.
4. **Mobile Applications and Digital Tools:**
    - Mobile applications that guide farmers through the CMT testing process step-by-step could be developed. These apps could include features such as reminders for

regular testing, video demonstrations, and platforms for farmers to record their CMT results and track udder health over time. Apps can also connect farmers to veterinarians if the test indicates infection.

5. **Educational Campaigns and Awareness Drives:**
    - **Public awareness campaigns** using radio, print media, and social media platforms can promote the importance of regular CMT testing. These campaigns should emphasize the economic benefits of early detection in terms of reducing milk yield loss, treatment costs, and AMR risks.
    - Educational material such as **flyers, posters, and videos** in local languages can be distributed at veterinary clinics, milk collection centers, and agricultural fairs to encourage routine mastitis screening.

Monitoring the Use of CMT Kits

Ensuring the sustained use of CMT kits requires continuous follow-up and monitoring:

1. **Periodic Farm Audits:** Extension workers or cooperative staff can visit farms to check whether CMT testing is being conducted regularly and guide farmers in interpreting results and taking corrective measures if necessary.
2. **Tracking and Rewarding Regular Testing:** KVKs and Cooperatives could implement **milk quality improvement programs** where farmers who demonstrate regular CMT use and good udder health management practices are rewarded through:
    - Farmers can be educated on the benefits of low somatic cell counts and regular CMT testing to improve milk quality and marketability.
    - **Recognition programs**, such as awards for farmers with the best mastitis control practices, encouraging peer learning and competition.
3. **Linking CMT Data to Veterinary Services:** Farmers could be encouraged to maintain **mastitis monitoring logs** where they record their CMT results over time. This data can be used to track udder health trends and flag early signs of mastitis, prompting timely intervention by veterinarians. Attempt could be made to develop a **database of CMT results** to monitor patterns and detect outbreaks early.

Conclusion: Empowering Farmers through CMT and TSC Distribution and Regular Testing

The regular use of CMT kits can drastically reduce the prevalence of mastitis by ensuring early detection and timely treatment, thus reducing milk yield losses and treatment costs. By making CMT kits widely available and training farmers on their proper use, dairy health in India can improve significantly. A combined approach of widespread distribution through government programs, dairy cooperatives, KVKs and veterinary services, along with farmer's education for regular testing, will contribute to long-term sustainable control of mastitis in dairy herds across the country.

Annexure-II

Management of Cows During the Dry Period for Mastitis Control

The dry period is a critical time in the management of dairy cows, as it plays a vital role in maintaining udder health and preventing mastitis in the subsequent lactation. Effective management during this phase is essential to reduce the incidence of both **clinical** and **subclinical mastitis**, which often develop during this period. Below are key strategies for managing cows during the dry period to minimize the risk of mastitis:

1. Dry Cow Therapy (DCT)

Dry cow therapy is one of the most effective methods for preventing new infections during the dry period and curing existing subclinical mastitis:

- **Selective Dry Cow Therapy (SDCT):** Treat only cows with high somatic cell counts (SCC) or a history of mastitis with antibiotics, while using internal teat sealants for healthy cows. This method prevents unnecessary antibiotic use, helping control antimicrobial resistance (AMR).
- **Selective Quarter Therapy (SQT):** Treat infected quarters only.
- **Teat Sealants:** Administer **internal teat sealants** to create a physical barrier that prevents the entry of bacteria into the udder during the dry period. This is particularly useful for cows with low SCC and no clinical mastitis. (Not available in India).

2. Proper Dry-Off Technique

- **Gradual Reduction in Milk Yield:** Before drying off, reduce the cow's milk production by adjusting the diet and reducing the frequency of milking. This helps prevent udder engorgement and the risk of bacterial infections.
- **Complete Dry-Off:** Incomplete drying off may create favorable conditions for bacterial proliferation, increasing the risk of mastitis.

3. Good Hygiene Practices

Maintaining a clean environment is critical to preventing environmental mastitis pathogens from entering the udder during the dry period:

- **Clean, Dry Housing:** Cows should be housed in well-ventilated, clean, and dry conditions. Regularly change bedding and ensure there is adequate drainage to prevent the buildup of moisture, which can foster bacterial growth. The flooring should be devoid of any holes which could cause water, dung and urine accumulation
- **Minimize Exposure to Pathogens:** Limit the cows' contact with contaminated bedding, manure, and other animals that could introduce mastitis-causing pathogens. Cows should be housed in low-stress environments with adequate space to prevent overcrowding.
- **Promote Timely and Efficient Milking:** Milking should be completed promptly—ideally within seven minutes per cow. When using milking machines, it is important to maintain appropriate vacuum pressure to ensure complete milk removal, thereby reducing the risk of mastitis associated with residual milk.
- **Emphasize Personal Hygiene in Milking Practices:** Individuals handling cows should follow strict hygiene protocols, including regular handwashing, keeping nails short and clean, and covering hair during handling and milking to minimize the introduction of pathogens.

4. Nutritional Management

Providing balanced nutrition during the dry period is essential for maintaining the immune system and promoting udder health:

- **Adequate Energy and Mineral Intake:** Ensure cows receive sufficient energy, protein, vitamins, and minerals, especially **Vitamin E** and **selenium**, which are important for boosting immune function and udder health.
- **Body Condition Score (BCS) Management:** Monitor the body condition score and avoid over-conditioning cows during the dry period. Obese cows are more susceptible to metabolic disorders and infections, which can increase the risk of mastitis.

5. **Monitoring and Early Detection**

Closely monitoring cows during the dry period helps in the early detection of potential mastitis infections:

- **Udder Checks:** Regularly check for signs of udder inflammation or abnormalities during the dry period, as this can indicate early stages of mastitis.
- **Use of Somatic Cell Count (SCC) Data:** Utilize SCC data from the previous lactation to identify cows that are at high risk of developing mastitis during the dry period. Implement appropriate treatment protocols for these animals.

6. **Transition Period Management**

The transition period, which spans three weeks before and after calving, is particularly sensitive for udder health:

- **Stress Reduction:** Minimize stress by ensuring cows have adequate space, fresh water, and a calm environment during the transition period. Stress can lower immune function and increase the risk of mastitis.
- **Calving Area Hygiene:** Ensure the calving area is clean and dry to prevent bacterial infections, as cows are especially vulnerable during this time due to changes in their immune system.

7. **Preventing New Infections**

Preventing new infections during the dry period is key to maintaining udder health:

- **Culling Chronic Mastitis Cases:** Identify and cull cows with chronic mastitis that do not respond to treatment. This reduces the risk of pathogen spread to other cows in the herd.
- **Biosecurity Measures:** Implement biosecurity measures, such as isolating infected cows and ensuring clean equipment, to prevent the introduction and spread of mastitis-causing pathogens.
- **Screen New Animals for Subclinical Mastitis (SCM):** All newly introduced animals should be tested for subclinical mastitis and appropriately

treated, if necessary, before being integrated with the existing herd. This helps prevent the spread of infection within the herd.

- **Use of Teat Dips:** The teats of dry-off cows after administration of dry cow therapy or without DCT should be dipped in germicidal solution for first two weeks. A separate solution should be used for lactating cows.
- **Use of Herbal Preparation:** In Dry cow therapy the EVM preparation (Aloe, turmeric and lime) can be used once or twice, every week until calving, to prevent mastitis.

8. Immune Support

While vaccines against mastitis are not always fully effective due to the diversity of pathogens involved, supporting the cow's immune system through proper nutrition and management is equally important.

By implementing these management practices during the dry period, dairy farmers can significantly reduce the incidence of mastitis in their herds, leading to healthier cows, improved milk production, and reduced reliance on antibiotics.

Annexure-III

Ethnoveterinary Medicine (EVM) in Management of Mastitis

Ethnoveterinary Medicine (EVM) encompasses the traditional knowledge, practices, and cultural beliefs that local communities use to maintain the health and well-being of their animals. This holistic approach includes the application of plant-based treatments, spiritual or ritualistic practices, manual therapies, and the use of locally sourced materials to prevent and manage livestock diseases.

Ethnoveterinary Medicine (EVM)has emerged as a promising alternative in the management of animal mastitis, particularly in the context of rising concerns over antibiotic resistance and drug residues in milk. Mastitis a common and economically significant disease in dairy animals. Conventional treatment involves antibiotics, but their frequent use poses risks including antimicrobial resistance, withdrawal periods, and milk contamination. As a result, there is growing interest in phytotherapy — the use of medicinal plants — for safer and sustainable mastitis control.

Many herbs possess anti-inflammatory, antibacterial, and immunomodulatory properties that make them effective against mastitis-causing pathogens. Plants such as turmeric (*Curcuma longa*), neem (*Azadirachta indica*), aloe vera, and garlic (*Allium sativum*) have demonstrated efficacy in reducing inflammation and microbial load in infected udders. These herbs can be applied topically, administered orally, or used as feed additives, often with fewer side effects than conventional drugs. Their active compounds, such as curcumin, allicin, and azadirachtin, work by inhibiting bacterial growth and modulating the immune response. Herbal medicine offers a valuable complementary approach in integrated mastitis management, aligning with the principles of organic and sustainable livestock farming.

Key Features of EVM:

- **Indigenous Knowledge:** Passed down through generations within communities.
- **Local Resources:** Utilizes herbs, minerals, and traditional tools available in the local environment.
- **Cultural Relevance:** Embedded in the social and cultural context of rural and pastoralist communities.

- **Cost-effective and Accessible:** Especially valuable in remote or resource-limited areas where modern veterinary services may be scarce.

Some of Important ailments related to udder and teats with detailed treatment given below:

1. **Blood in Milk**

Ingredients: For one day

Curry leaves - 2 handfuls; Moringa leaves - 2 handfuls; Jaggery - 100 g; Lemon - 6 nos

Preparation:

Blend curry and moringa leaves to a paste along with jaggery. Cut the lemon in two halves.

Application:

I. Feed the paste twice daily till the condition resolves.

II. Feed two lemons at a time orally (cut in two halves) thrice a day for 3 days.

Note: Carry out EVM treatment for mastitis also.

2. **Mastitis (all types)**

Water-based Preparation:

Ingredients: For one day

Aloe vera - 250 g; Turmeric powder - 50 g; Calcium Hydroxide (lime)-15 g; Lemon - 6 nos.

Preparation:

I. Cut Aloe vera whole leaf into small pieces (after removing the thorns).

II. Blend along with turmeric powder and lime to form a reddish paste.

Application:

I. Wash, clean and completely milk out all quarters (including unaffected).

II. Take a handful of the paste and add 200ml of water to make it thin.

III. Apply the paste diluted in water ten times a day for 5 days each time after following the step (i) above.

IV. Last application of the day should be oil-based preparation.

V. Feed two lemons at a time orally (cut into halves) thrice a day for 3 days.

3. Oil-based Preparation:

Ingredients: For one day

Aloe vera (whole leaf) - 250 g; Turmeric powder - 50 g; Calcium hydroxide (lime) - 15 g; Lemon - 6 nos; Mustard or Gingelly oil - 600 ml.

Preparation:

I. Cut Aloe vera whole leaf into small pieces (after removing the thorns).

II. Blend along with turmeric powder and lime to form a reddish paste.

Application:

I. Wash, clean and completely milk out all quarters (including unaffected) and dry the udder.

II. Take a handful of the paste and add 200ml of mustard or gingelly oil to make it thin.

III. Apply the paste diluted in oil three times a day for 5 days each time after following the step (i) above.

IV. Feed two lemons orally at a time (cut into halves) thrice a day for 3 days.

4. Teat obstruction

Ingredients:

Freshly plucked & clean neem leaf stalk-1; Turmeric powder; Butter or Ghee

Preparation:

I. Nip the neem leafstalk from the top at the required length based on teat length, leaving the base intact.

II. Coat the turmeric powder & butter/ghee mixture thoroughly on the neem leafstalk.

III. Clean the affected teat opening thoroughly.

Application:

I. Insert the coated neem leafstalk with cut end up, base down into the affected teat in an anticlockwise direction

II. Replace with fresh neem stalk after each milking.

5. **Udder Oedema**

Ingredients: For one time

Sesame or mustard oil - 200 ml; Turmeric powder- 1 handful; Garlic-2 pearls.

Preparation:

I. Heat oil, add turmeric powder and sliced garlic.

II. Mix well and remove from flame just as the flavour develops (no need to boil).

III. Allow to cool.

Application:

I. Apply in a circular manner with force over the entire oedematous region and udder.

II. Apply 4 times a day for 3 days.

Note: Rule out mastitis before using the formulation

Annexure-IV

Suggestive Photographs related to Mastitis