Using ethno veterinary medicines (EVM) to reduce antibiotic usage in bovines

Dr A V Harikumar
Group Head (Animal Health)
NDDB, Anand
Presentation overview

- About NDDB
- Dairying in India
- EVM: The rationale
- NDDB’s experience
- Achievements and outcomes
- Acknowledgements
National Dairy Development Board

Registered as society in September 1965, declared as an Institute of National Importance in 1987 by an Act of Parliament

Objectives:

• To promote Anand Model of Cooperatives across the country

• To promote, finance and support producer-owned and controlled organizations

• To strengthen farmer cooperatives and support national policies that are favorable to the growth of such institutions
Operation Flood and other programmes by NDDB


- Perspective plan

- National Dairy Plan: 2011-12 to 2018-19

<table>
<thead>
<tr>
<th>Year</th>
<th>1970</th>
<th>1996</th>
<th>2018-19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk production in Million MT</td>
<td>21.2</td>
<td>66.2</td>
<td>187.7</td>
</tr>
</tbody>
</table>
Dairying in India

Herd size per holding

<table>
<thead>
<tr>
<th>Country</th>
<th>Herd size</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>2</td>
</tr>
<tr>
<td>France/Germany</td>
<td>60</td>
</tr>
<tr>
<td>Netherlands</td>
<td>97</td>
</tr>
<tr>
<td>USA</td>
<td>160</td>
</tr>
<tr>
<td>New Zealand</td>
<td>283</td>
</tr>
</tbody>
</table>

Bovine holding

<table>
<thead>
<tr>
<th>Size</th>
<th>Rural households</th>
<th>Area operated</th>
<th>Bovine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi medium, medium &amp; large (&gt;2 Ha.)</td>
<td>7%</td>
<td>47%</td>
<td>15%</td>
</tr>
<tr>
<td>Landless, marginal &amp; small (&lt;2 Ha.)</td>
<td>93%</td>
<td>53%</td>
<td>85%</td>
</tr>
</tbody>
</table>


Rural income source

<table>
<thead>
<tr>
<th>Area operated</th>
<th>Bovine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural households</td>
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<tr>
<td>Landless, marginal &amp; small (&lt;2 Ha.)</td>
<td>93%</td>
</tr>
</tbody>
</table>

Situation Assessment Survey: The livestock sector contributes significantly to rural income

- About 26% in case of the poorest households
- Overall it contributes to about 12% of rural income

Source: IFCN Dairy Report
**Contribution of milk in Indian Economy**

**Value of output : ₹ billion at current prices**

- Generates 5-6% of total rural employment
- Major source of rural employment, especially women employment
- Subsidiary income- contributes about 12% of rural household income
- Dairying an instrument for rural prosperity & change with gender inclusion

<table>
<thead>
<tr>
<th></th>
<th>90-91</th>
<th>00-01</th>
<th>10-11</th>
<th>2018-19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>282</td>
<td>964</td>
<td>2638</td>
<td>7727</td>
</tr>
<tr>
<td>Paddy</td>
<td>253</td>
<td>656</td>
<td>1523</td>
<td>3054</td>
</tr>
<tr>
<td>Wheat</td>
<td>151</td>
<td>438</td>
<td>1028</td>
<td>1943</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>65</td>
<td>170</td>
<td>519</td>
<td>1056</td>
</tr>
</tbody>
</table>

- Value of milk output is more than the combined value of paddy, wheat & sugarcane
- Milk accounts for about 67% of total value of output from livestock

*Source: SAS Group, NDDB*
EVM: The 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)
Antibiotic usage in various milk producing organisations

- Betalactams
- Sulpha/Quino/Amino
- Tetracycline and others
EVM propagation

Project coverage
- ~1000 DCSs
- >16 Milk Unions
- 9 States

Training on EVM
- 1084 vets trained
- 7691 AH personnel

Period
- Since 2017-18

Case records
- 5.73 lakh cases recorded for various ailments

Demo plots
- 570 demo plots established
>5,73,000 cases with 81% cure rate at present

8100 cases with 78% cure rate in 2017-18

Data captured through an online system
On-line data capture

Animal Health Management Information System

Welcome to Animal Health Management Information System

It is estimated that 15% of the total farm animals are affected by mastitis. A significant percentage of mastitis cases remain undetected. Mammary gland infection of the udder is due to the sub-clinical form. The farmer usually remains unaware of the existence of this form in his farm. The system has been formulated to identify and treat sub-clinical mastitis which is cost effective and farmer friendly.

This will also address issues related to antibiotic residues which are endemic in the farmer for which posters, hand-outs etc are provided at the EVM.

Extension also plays a vital role in awareness creation and transfer of knowledge to manage all forms of mastitis and also for effective management of other ailments by the farmer.
Ailments managed by EVM with >100,000 empirical data

- **Mastitis**: 182,000 cases treated, 144,800 cured, 80% cure rate
- **Fever**: 113,200 cases treated, 94,600 cured, 84% cure rate
- **Diarrhoea**: 110,100 cases treated, 83,700 cured, 85% cure rate
Ailments managed by EVM with >10,000 empirical data

<table>
<thead>
<tr>
<th>Ailment</th>
<th>Treated</th>
<th>Cured</th>
<th>Cure %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigestion</td>
<td>27.4</td>
<td>23.0</td>
<td>84%</td>
</tr>
<tr>
<td>Anoestrus</td>
<td>17.6</td>
<td>13.1</td>
<td>75%</td>
</tr>
<tr>
<td>Blood in Milk</td>
<td>15.8</td>
<td>13.3</td>
<td>84%</td>
</tr>
<tr>
<td>Repeat breeding</td>
<td>13.3</td>
<td>9.0</td>
<td>68%</td>
</tr>
<tr>
<td>Worm infestation</td>
<td>12.0</td>
<td>10.8</td>
<td>90%</td>
</tr>
<tr>
<td>FMD (mouth lesions)</td>
<td>10.0</td>
<td>8.7</td>
<td>87%</td>
</tr>
</tbody>
</table>
Ailments managed by EVM with >5000 to <10,000 empirical data

<table>
<thead>
<tr>
<th>Ailment</th>
<th>No. of cases in '000</th>
<th>Percentage cure rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastitis</td>
<td>9.8</td>
<td>78%</td>
</tr>
<tr>
<td>Udder oedema</td>
<td>9.6</td>
<td>84%</td>
</tr>
<tr>
<td>FMD (Foot lesions)</td>
<td>7.2</td>
<td>83%</td>
</tr>
<tr>
<td>Wound</td>
<td>6.7</td>
<td>82%</td>
</tr>
<tr>
<td>Retention of placenta</td>
<td>5.8</td>
<td>71%</td>
</tr>
<tr>
<td>Bloat</td>
<td>5.2</td>
<td>76%</td>
</tr>
</tbody>
</table>

**Notes:**
- Treated: 9.8, 9.6, 7.2, 6.7, 5.8, 5.2
- Cured: 7.6, 8.0, 6.0, 5.4, 4.1, 4.0
- Cure %: 78%, 84%, 83%, 82%, 71%, 76%
Ailments managed by EVM with >2000 to <5,000 empirical data

<table>
<thead>
<tr>
<th>Condition</th>
<th>No. of cases in '000</th>
<th>Percentage cure rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ectoparasitic control</td>
<td>4.2</td>
<td>83%</td>
</tr>
<tr>
<td>Teat obstruction</td>
<td>3.5</td>
<td>67%</td>
</tr>
<tr>
<td>Swollen joints</td>
<td>2.7</td>
<td>74%</td>
</tr>
<tr>
<td>Downer</td>
<td>2.4</td>
<td>66%</td>
</tr>
<tr>
<td>Agalactia</td>
<td>2.7</td>
<td>75%</td>
</tr>
<tr>
<td>Wart</td>
<td>2.7</td>
<td>71%</td>
</tr>
<tr>
<td>Lumpy Skin Disease</td>
<td>2.3</td>
<td>75%</td>
</tr>
</tbody>
</table>

- Treated
- Cured
- Cure %
Achievements and outcomes

Extension and awareness creation (11 vernacular languages and English)

- Brochures, Posters, e Gopala application (Play Store), farmer training, farmer exhibition
- Facebook page to document success stories
- 276 videos on EVM preparation and application methods for various ailments
- IDF Health report, various journals
- Access Agriculture – EcoAgTube

Increase in awareness levels on EVM and antibiotic residues in milk

- Six fold reduction in antibiotic preference for mastitis treatment
- Double fold increase in awareness on antibiotic residues in milk

Training

- ~260 core group veterinarians
- >750 veterinarians trained by core group locally
- >160 EVM demo plots at MU/PC level; 392 at MCC

Seminars & conferences

- International seminar
- IDF Conferences: Nantes, Dublin, Copenhagen
- OIE Conference, Marrakesh
Cost reduction due to extensive use of EVM in a milk union

<table>
<thead>
<tr>
<th>Year</th>
<th>Medicine Cost (Rs. in Million)</th>
<th>Antibiotic Cost (Rs. in Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-18</td>
<td>46.12</td>
<td>18.86</td>
</tr>
<tr>
<td>2018-19</td>
<td>41.36</td>
<td>16.12</td>
</tr>
<tr>
<td>2019-20</td>
<td>32.60</td>
<td>6.55</td>
</tr>
<tr>
<td>2020-21</td>
<td>34.31</td>
<td>5.44</td>
</tr>
</tbody>
</table>
Impact of extensive use of EVM in a milk union

![Graph showing antibiotic costs over years]

- **Antibiotic Costs (Rs. in million)**
  - 2017-18: 18.86
  - 2019-20: 6.55
  - 2020-21: 5.44

- **Antibiotic Cost / Visit (In Rs.)**
  - 2017-18: 31.81
  - 2018-19: 28.21
  - 2019-20: 12.77
  - 2020-21: 11.47
EVM impact in a milk union

- The medicine costs (antibiotics, NSAID and other supplements) are reducing at the compounded annual rate of around 16% over the last 3 years.
  - Over 191 lakh saved
- A total of 79,832 veterinary calls have reduced in 2019-20 compared to 2017-18.
  - Percolation of the EVM concept to the farmers
  - More focus on field activities like infertility/health camps etc by vets.
Wart- Before & after EVM
AMR profiling: Mastitis samples

Milk samples

Sub clinical mastitis  Clinical mastitis

Isolation & Identification of Organism

Antibacterial Sensitivity

Phenotypic
Disc Diffusion
BD System

Advisory to MU/States Surveillance of AMR

Genotypic
Identification of Resistance Gene by WGS and PCR

Culture & PCR Repository
Staphylococcus sp., Streptococcus sp., E. Coli and Klebsiella sp., mostly associate with mastitis

Isolates exhibited variable pattern of resistance mainly to β-lactam, aminoglycosides, tetracyclines & sulfanomides

S aureus: high proportion MRSA, categorized in 6 spa, 8 MLST types & 2 agr types (I&III)

No specific pattern of geographical distribution could be observed in respect to above characterization

Results also indicated likelihood of inter-species infection with the same types
Acknowledgements
Thank you for your kind attention

Please visit us at:

1. NDDB Facebook
2. NDDB Dairy Knowledge portal
3. Traditional Herbal Formulations for cattle and buffaloes FB page
Prolonged exposure to manure from livestock-administered antibiotics decreases ecosystem carbon-use efficiency and alters nitrogen cycling

Abstract

Microbial communities drive soil ecosystem function but are also susceptible to environmental disturbances. We investigated whether exposure to manure sourced from cattle either administered or not administered antibiotics affected microbiologically mediated terrestrial ecosystem function. We quantified changes in microbial community composition via amplicon sequencing, and terrestrial elemental cycling via a stable isotope pulse-chase. Exposure to manure from antibiotic-treated cattle caused: (i) changes in microbial community structure, and (ii) alterations in elemental cycling throughout the terrestrial system. This exposure caused changes in fungal : bacterial ratios, as well as changes in bacterial community structure. Additionally, exposure to manure from cattle treated with pirlimycin resulted in an approximate two-fold increase in ecosystem respiration of recently fixed-carbon, and a greater proportion of recently added nitrogen in plant and soil pools compared to the control manure. Manure from antibiotic-treated cattle therefore affects terrestrial ecosystem function via the soil microbiome, causing decreased ecosystem carbon use efficiency, and altered nitrogen cycling.
Popularisation measures - Brochures
Popularisation measures - eGopala
Farmer training (saplings provided)
Farmer exhibitions
Popularisation measures - Facebook page on success stories

Traditional herbal formulations for cattle and buffaloes
@mopp.nddb.coop

Published by Pankaj Dutta [2] - August 20

Successful treatment with EVP: A Case of bovine mastitis with thelitis in a primiparous Buffalo

Name of the Owner: Sri Tatinten Raghava.
Village: Chiruru gudem.
District: Krishna district, A.P.... See More

Before treatment with EVP

In 6th Day of EVP
HEALTH – MASTITIS

Mastitis control: a sustainable model for the developing world

AUTHOR
National Dairy Development Board (NDDB) - Vrindavan

UK DOI: https://doi.org/10.1016/j.tij.2020.10.004

SUBJECT
- Mastitis control for sustainable dairy production
- Development of a sustainable model for the control of mastitis
- Economic and social implications of mastitis control

SUMMARY
- Mastitis is a major economic and health issue in dairy production worldwide.
- Development of a sustainable model for mastitis control is crucial for the dairy sector.
- The model includes a combination of dairy hygiene, nutrition, and health management practices.
- Economic and social benefits can be achieved through sustainable mastitis control.

GLOBAL AGENDA FOR SUSTAINABLE LIVESTOCK

Good practices for responsible use of antibiotics

- Reducing the use of antibiotics in dairy production
- Implementing alternative strategies for disease control

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 10% of the antibiotics used. During the last decade, a successful large improvement in cattle health has taken place. Milk production can manage on the basis of health due to a focus on nutritious or antimicrobial management strategies. Sustained high quality milk is essential to reduce the production of primary quality milk and better economic quality for the consumer. Good prevention and management of dairy animal welfare will reduce food loss and risk the whole chain times lines. It is important to put a balanced plan for the dairy sector and sustainability should be applied.

Diminishing mastitis to limit antibiotic use

System 4: 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 10% of the antibiotics used. During the last decade, a successful large improvement in cattle health has taken place. Milk production can manage on the basis of health due to a focus on nutritious or antimicrobial management strategies. Sustained high quality milk is essential to reduce the production of primary quality milk and better economic quality for the consumer. Good prevention and management of dairy animal welfare will reduce food loss and risk the whole chain times lines. It is important to put a balanced plan for the dairy sector and sustainability should be applied.

Ethnoveterinary medicine for responsible dairying

Diby Ranjan Ghosh, Kritik Kumar Sharma and Yogesh C. Solanki

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

K. K. Sharma(1), S. K. Sharma(2), S. J. Dehlvi(3)
(1) Department of Ayurveda, Patanjali Research Foundation, Haridwar, India
(2) Indian Veterinary Research Institute, Izatnagar, India
(3) Department of Ayurveda, Patanjali Research Foundation, Haridwar, India

The use of Ayurvedic medicine in dairy animal production is becoming popular due to its effectiveness and safety. Ayurvedic formulations are known for their ability to treat various ailments in dairy animals. The use of Ayurvedic medicine is gaining traction due to its holistic approach and minimal side effects. The present review aims to highlight the use of Ayurvedic medicine in the management of common ailments in dairy animals and the benefits of its integration into modern dairy farming practices.
NDDB becomes EcoAgtube superstar

We are proud to announce that the organisation with the most video uploads on EcoAgtube currently is India's National Dairy Development Board (NDDB), with over 100 videos on a range of topics relating to dairy farming. The efforts of NDDB transformed India's rural economy by making dairying a viable and profitable economic activity for millions of milk producers.

If your Project relates to ecology and you want to create a Project video page on EcoAgtube, please send your request with details (Project name, description) to: support@ecoagtube.org.
Effect of field model on awareness levels

- Aware of sub-clinical mastitis: 32% (Baseline survey), 90% (Annual survey)
- Aware of EVM for mastitis: 34% (Baseline survey), 60% (Annual survey)
- Prefer antibiotics for treating mastitis: 47% (Baseline survey), 8% (Annual survey)
- Aware of antibiotic residues in milk: 25% (Baseline survey), 56% (Annual survey)

Comparisons:
- Baseline survey (1717)
- Annual survey (1666)
Training of vets from 34 MU/PCs on EVM

4 day training of vets at TDU, Bangalore on EVM and antibiotic residue field testing in 5 batches - May-Jun’17

The 4 day training at TDU followed by a 3 day field training at 7 locations across the country clubbing the unions as per regions for convenience – Aug-Sept’17

Erode
Bangalore
Kolhapur
Vijayawada
Mehsana
Mysore
Mohali
Training on monitoring antibiotic residues and other parameters in bulk milk
AMR pattern from clinical mastitis

- 47 CM cases from 23 villages
- 135 isolates
- 11 types of bacteria:
  - *S. aureus*
  - *Strep agalactiae*
  - *Enterobacter*
  - *E. coli*
  - *Klebsiella*
  - *Strep. dysgalactiae*
  - *S. intermedius*
  - *S. epidermidis*
  - *Strep. enterofaecalis*
  - *B. subtilis*
  - *B. cereus*

Resistant to:
- 1 antibiotic
- 2 antibiotics
- 3 antibiotics
- 4 antibiotics
- Sensitive to all antibiotics

- Gentamicin: 7%
- Enrofloxacin: 44%
- Ampicillin/ cloxacillin: 98%
- Ceftriaxone + tezobactum: 0%
- Cefoperazone / sulbactam: 18%
- Tetracycline: 21%
AMR pattern from sub clinical mastitis

- 115 SCM cases from 23 villages
- 401 isolates
- 11 types of bacteria:
  - *S. aureus*
  - *Strep agalactiae*
  - *Enterobacter.*
  - *E. coli*
  - *Klebsiella*
  - *Strep. dysgalactiae*
  - *S. intermedius*
  - *S. epidermidis*
  - *Strep. enterofaecalis*
  - *B. subtilis*
  - *B. cereus*
AMR surveillance – An AMR sampling kit contents

- Paper napkin
- Marker pen
- Sterile gloves
- Alcohol wipe
- Sterile tube
- Bronopol tablet
**AMR surveillance - Instruction manual**

**Instruction for milk sample collection from mastitis cases**

**Step 1:** Wipe udder with napkin  
**Step 2:** Disinfect with sponge

**Step 3:** Open vial (wear gloves)  
**Step 4:** Secure the lid of vial

**Step 5:** Add tablet into vial  
**Step 6:** Collect milk (40 ml)

- Bronopol tablet

**Step 7:** Close lid tightly & mix  
**Step 8:** Label sample (dry area)

**Transport and storage**
- Transport sample in **cold chain** (2-8°C).
- **Freeze** the sample once it reaches the centralized location.
- **Intimate** the courier agency on the same day on the mobile number provided by NDBB.

**Label Description**

<table>
<thead>
<tr>
<th>Date of Collection (DD/MM/YY)</th>
<th>Unique DCS code (As provided in MCPP reporting system)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species: C- Cattle B-Buffalo</td>
<td>Farmer member code at society (from whose animal sample is collected)</td>
</tr>
<tr>
<td>Quarter from which collected</td>
<td>Quarter from which collected (as applicable): LF (Left Fore); LH (Left Hind); RF (Right Fore); Right Hind (RH) and Composite (C) if from more than one quarter.</td>
</tr>
</tbody>
</table>

**Precaution:** Use only a marker pen for labelling

**Label Example**

- 04/07/18
- SAB01
- C
- 3256
- LF

*Transport & Storage and description of label content along with example given over leaf*
AMR Studies - Reports

**1. Isolates**

<table>
<thead>
<tr>
<th>Isolate</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cont. mrsa pathogenic</td>
<td>43%</td>
</tr>
<tr>
<td>Enterococcus mrsa pathogen</td>
<td>43%</td>
</tr>
<tr>
<td>Others</td>
<td>14%</td>
</tr>
</tbody>
</table>

**2. Antibiogram**

<table>
<thead>
<tr>
<th>Bacterial Isolates (Bron: 30x20)</th>
<th>Sensitive</th>
<th>Intermediate</th>
<th>Resistant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staphylococcus aureus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staphylococcus chromogenes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staphylococcus schleiferi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Streptococcus dysgalactiae sap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dysgalactiae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Streptococcus uiberis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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