

Ethno-veterinary science and practices as game changer in the 21st century

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I present this work on behalf of all the people: the knowledge holders, Prof. Puniamurthy, my collegues and our partners -TANUVAS, NDDB, MILK Unions from 14 states, KSVC, several trained veterinarians, village resource persons, officers from the milk unions and farmers; DST India, ETC Netherlands, NLF foundation, GLOHMSIWA (NLF India), NLF Netherlands, NLF **Etiopia and NLF Uganda – who are directly or indirectly** associted with Developing and mainstreaming Ethnoveterinary Science and Practices.

Why Ethno-veterinary practices EVP

- It is a decentralized local knowledge and resource specific health care management regime
- Can be prepared and used by farmers themselves as the first response to primary health care needs of animals
- Cost effective and efficacious practices
- Reduces use of antimicrobials and other chemical veterinary drugs



Rational of Practices for cattle health

- The dairy sector in India is an important component in rural livelihoods.
- To enhance production of milk, a cross-breeding strategy with exotic breeds was introduced in India in the 1960s.
- Side effect of this strategy was a high disease incidence in cross-breed animals
- Extensive use of antimicrobials without effective implementation of regulatory policy leading to high veterinary drug residues in the animal products like milk

Rational cont...



- High treatment cost
- Threats to human health due to AMR which is worldwide problem today
- Loss of local breeds which have resistance to many diseases
- Weak animal and poor farm management
- Reduced Milk quality





Alternative Approach

- Efficacious and safe EVP (herbal formulations) are available in India
- They are used in preventing and curing certain clinical conditions in livestock thereby reduced the drug residues in the milk



Traditional systems of medicine in India

- **Codified systems** (Ayurveda, Siddha, Unani and Tibetan) is based on the theory of physiological functioning, disease aetiology and clinical practices.
- It is legal in India
- Non-codified: oral or folk traditions: As old as human kind, Symbolic relationship with codified system, dynamic, innovative, evolving spread across 4639 ethnic communities all over India.
- They are location and ethnic community specific health related practices, lifestyles, food habits, customs, and beliefs.





- Brahmasri Nakeri Vasudevan Namboothiri
- Chairman: GTNG Educational Trust Reg.No.87 /IV /18 Sri Mookambika road, Nakeri Mana ,Guruvayur 680101
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Maatanga Leela

1.Navamadhikaaram

a.Mada bheda niroopana Gaja Santhushti, Dhatu vidhi

2. Ekadasadhikaara

a.Gajarakshadhikara Gaja klesa, Poorva Smarana 3. **Dwadasadhikara** a. Adhoraadi vichara Nagadhyaksha Lakshana, Adhorana



Paallakaapya Thantra (4. Divisions)

- 1.Maharogadhyaaya (18 Chapters) 7th Chapter onwards
- 7.Roga Vibhakti, 8. Jwra, 9.Pakala, 10.Skanda, 11.Pandu, 12. aanaha, 13. Murcha, 14. Siroroga, 15. Padaroga, 16. Asta Vyapad, 17. Sopha,18. Sweda
- Kshudraroga adhikara (72 Chapters)
 Salyasthana (34 Chapters)
- 4. Uttarastahana (36 Chapters

A rich ethno-veterinary health tradition exists in India.













- > 6500 plants
- > 200 animal and other resource
- > 50,000 herbal formulation



EVP in India



- One of the key challenges is to find out the effectiveness and contemporary relevance of these practices (Safety and efficacy).
- Revalidating these formulations based on western pharmacology is a cross cultural or Trans Disciplinary exercise.



DOCUMENTATION & RAPID ASSESSMENT OF EVP



Ethno-veterinary practices

- TDU and TANUVAS had documented Ethno-veterinary practices from 24 locations from 10 states
- Established that 353 out of 441 formulations documented are safe and efficacious.
- 24 remedies have gone through clinical observation studies.







Rapid assessment of EVP

- Involves a judicious blend of
 - Local experience
 - Clinical experience of ISM (Ayurveda, Siddha, Unani and Gso-rig-pa)
 - Western Medicine





EVP: how you relate it to scientific evidence?

- The degree of the effectiveness of the folk medicine is impressive as it ranges from 60-90%
- Because of high effectiveness of the herbal formulations indicates that they have been obviously designed with pharmacological logic
- The logic is based on Ayurveda pharmacology called "*Dravya Guna Shastra*"



EVP: how you relate it to scientific evidence

- Revalidating these formulations based on western pharmacology is a cross cultural or Trans Disciplinary exercise.
- It would require extensive studies on advanced combinatorial chemistry as poly herbals are involved.
- Need systemic experimental pharmacology studies with innovative bioassays because conventional bioassays are far too fractured and inadequate to detect simultaneous changes on multiple targets



EVP: how you relate it to scientific evidence Cont..

- Current approach of creating objective and verifiable standards for traditional knowledge products and concepts is one-sided
- Therefore, an intercultural (subjective and Objective) approach involving consultation between traditional and western health sciences is necessary to promote mutual understanding which could create relevant quality standards

Trans - disciplinary knowledge



- We define trans-disciplinary studies as the understanding and describing of universe through different word views and epistemologies of various knowledge systems.
- Evolve research methodology that accommodates two different epistemologies viz. Holistic, systemic framework of traditional knowledge with the reductionist and structural frame work of western sciences



Example of EVP remedy for Mastitis

















Note: In the case of chronic mastitis add *Cissus quadrangularis* in the formulation and the treatment should be continued till the hardness of the udder is completely disappear



Assessments - Ayurveda

- This formulation consists of *Curcuma longa*, *Aloe vera* and Calcium hydroxide
- Have properties of Vrana shodaka (Wound cleanser), Vrana ropaka (Wound healing) and very good Zhotha hara⁴ (anti-inflammatory), Puti rodhaka (anti-infective) and Krimihara (anti-microbial)
 - ✓ This remedy is very much beneficial in Mastitis.



References:

- Bhava prakasha Nighantu
- Kaiyya deva Nighantu
- Raja Nighantu
- Shodala Nighantu
- Dhanvanthari Nighantu
- Astanga hrudaya sootrasthana 14 / 8







In-Vitro Antimicrobial Activity of Ethno-veterinary Herbal Preparation for Mastitis

The antimicrobial activity of aqueous, ethanol and ethyl acetate extracts obtained from *Aloe vera* and *curcuma longa* assayed in-vitro using agar well diffusion method exhibited antimicrobial activity against *Escherichia coli*, *Staphylococcus aureus* and *Pseudomonas aurogenosa*.

Dairy and Vet Sci J Volume 3 Issue 2 - August 2017 DOI: 10.19080/JDVS.2017.03.555607 Copyright © All rights are reserved by Nair MN B reduction of pH, Electrical Conductivity (EC) and Somatic Cell Count (SCC)before and after treatment with herbal formula in comparison with normal values.





Nair M N B, et al. 2017. Ethno-veterinary Formulation for Treatment of Bovine Mastitis, *RRJVS/ Journal of Veterinary Sciences* S1. 25-29.



Reverse pharmacology

The bioactive compounds were tested for its effect against the target proteins of *Staphylococcus aureus* using molecular docking studies.

Punniamurthy et al. 2017.IJANS Vol. 6, Issue 5, Aug – Sep 2017; 23-30

Target	PDB ID	Structure of target	Total binding sites	
BPL	3V75	A A A A A A A A A A A A A A A A A A A	7	
DNA gyrase	3G7В		5	
ориСВ	3066		14	
sirA	ЗМWF	A	7	
SrtA	1T2W		14	
РВР	3VSL		44	



- Many bioactive components of *Aloe vera* and turmeric interact with target protein
- component of lime had lesser interaction with lesser affinity
- The pharmacodynamics study using online server PASS reveal that the compound in the preparation posses anti-inflammatory and antimicrobial properties (Punniamurthy et al. 2017)



Figure 2: Bar plot of phylum level bacterial abundance of all 64 milk samples



Figure 3b: Abundance of *Streptococcus* and *Staphylococcus* in the milk samples from Mastitis affected cow before and ater treatment with antibiotic





Figure 3a: Abundance of *Streptococcus* and *Staphylococcus* in the milk samples from Mastitis affected cow before and ater treatment with Herbal formulations

Microbial Abundance and taxonomic Classification in the healthy cow (CMT negative)



Treated with Doecf + citriaxone +Sulbactum 3 gr + Melpol (Meloxium paracetamol) 15 ml + Avil 10 ML (IM). Treated for 5 days



Genus level bacteria	Before Treatment	After 3 days of Treatment	After 6 days of Treatment	Quarter
Streptococcus	3.8%	38.4%	0.02%	F1
Enterobacteriacea family	1.1%	1.1%	51.6%	F1
Pseudomonas	2.1%	3.8%	2%	F2
Staphylococcus	42%	1.04%	34.7%	F2
Staphylococcus	4%	8.6%	0.19%	B3
Enterobacteriaceae family	2.2%	3.2%	70%	B3
Pseudomonas	1.5%	1.8%	2.6%	B3
Enterobacteriaceae family	8.7%	3.1%	4%	B4
Staphylococcus	3.3%	3.3%	0.02%	B4



Genus level bacterial abundance – treated with Moxel forte for 3 days

Genus level bacteria	Before	After 3 days of	After 6 days	Quarter
	Treatment	Treatment	of Treatment	
Streptococcus	37%	1.2%	0.19%	F1
Staphylococcus	9%	1.4%	0.4%	F1
Enterobacteriaceae	31%	3.2%	58%	F1
Enterococcaceae family	47%	5%	14%	F2
Streptococcus	7%	0.9%	2.6%	F2
Staphylococcus	5.7%	0.8%	11%	F2
Pseudomonas	1.05%	4.8%	1.1%	B 3
Streptococcus	0.1%	1.2%	31%	B 3
Enterococcaceae family	53 %	0.5%	0.07%	<u>B</u> 4
Pseudomonas	15%	3.6%	0.58%	B 4
Genus level bacterial abundance -EVP treatment -1



Genus level bacteria	Before EVP Treatment	After 3 days of Treatment	After 6 days of Treatment	Quarter
Staphylococcus	5.1%	0.18%	4.3%	F1
Streptococcus	2.17%	0.02%	2.8%	F1
Pseudomonas	2.3%	42.7%	1.9%	F1
Enterobacteriaceae family	4.8%	22.6%	1.5%	F1
Staphylococcus	59.3%	5.8%	5.4%	F2
Enterobacteriaceae family	0.3%	<u>39%</u>	2.84%	F2
Pseudomonaceae family	17.6%	Nil	Nil	B 3
Enterobacteriaceae family	9.4%	36%	2.5%	B 3
Staphylococcs	8.8%	4.2%	5%	B 3
Klebsiella	-	3.9%	0.2	B 3
Pseudomonadaceae family	12.16%	1.1%	3.9%	<i>B4</i>
Enterobacteriaceae family	1.6%	37.7%	2.3%	<u>B</u> 4
Staphylococcus	0.9%	5.3%	6.1%	B 4

Genus level bacterial abundance - EVP tratment-2



Genus level bacteria	Before EVP	After 3 days	After 6 days	Quarter
	treatment	of treatment	of treatment	
Streptococcus	0.1%	2.4%	5.7%	F1
Staphylococcus	60.7%	1.6%	2.1%	F1
Staphylococcus	45%	11%	1%	F2
Enterococcaceae family	27%	2%	0.1%	F2
Streptococcus	31%	2.2%	1.4%	B3
Pseudomonas	1.8%	1.8%	8.2%	B3
Streptococcus	<mark>30</mark> %	2.3%	0.8%	B4
Staphylococcus	31.4%	1.6%	1.6%	B4

Genus level bacterial abundance - EVP treatment -3



Genus level bacteria	Before EVP Treatment	After 3 days of Treatment	After 6 days of Treatment	quarter
Streptococcus	5%	0.04%	5%	F1
Staphylococcus	30%	28%	1%	F1
Enterobacteriaceae	10%	0.3%	0.8%	F1
Streptococcus	28%	9%	1.9%	F2
Staphylococcus	34%	1.4%	0.7%	F2
Enterobacteriaceae	23%	0.23%	3.1%	F2
Streptococcus	30%	29%	0.1%	B3
Staphylococcus	49.3%	38%	0.13%	B3
Enterobacteriaceae family	11%	0.7%	1.8%	B3
Staphylococcus	46.8%	1.65%	2.1%	<i>B4</i>
Streptococcus	2.1%	10%	3.8%	<i>B4</i>
Enterobacteriaceae	0.7%	5.2%	6.8%	<i>B4</i>

Herbal spray for Mastitis



R and D	remark
Ideation, 3 Months prototype	4 prototype developed (March 2018 June 2018)
Field trial for selection of beast combination	Final combination is selected (Jan 2020)
Testing & Validation, Field study	Field study 1 ,2, 90 % efficacious only 19 cases (only clinical mastitis) third study is on
Lab study done March 2020	Herbal formulation against mastitis had inhibitory activity against <i>E. coli</i> and <i>S. aureus.</i>
Microbiome study before and	the average abundance of <i>Staphylococcus</i> was reduced from 40.59% to 2.03% (20
after treatment	times), Streptococcus from 25.8% to 2.06 (12.52 times), Pseudomonaceae family
After 6 days of treatment with	20.28% to 1.9% (10.67 times), Klebsiella from 8.4% to 0.26% (32.31 times) and
herbal formulations	Enterobacteriaceae family from 24% to 1.69 % (14.37 times)
Toxicological study	Done -Non toxic
Patent application	Process patent application submitted
shelf- life study	Good stability , Stability up to 1 year
Phytochemical study	Will have to do
Clinical trial	Will have to do
Scale up manufacture and sale	By end 2022



Feedback from various milk societies from NDDB through INAPH * on the Efficacy of EVPs for 24 clinical conditions in cattle from 2017-18 to 2021-22

S No	Ailment	Total treated cases	Total clinical recovery	% clinical recovery
1	Fever	113172	94583	83.6
2	Diarrhoea	110046	93658	85.2
3	Acute Mastitis	104475	82878	79.3
4	Chronic mastitis	52791	41502	78.6
5	Indigestion	27358	22961	83.9
6	Sub-clinical Mastitis	23986	19780	82.5
7	Anoestrus	17617	13132	74.5
8	Blood in milk	15718	13269	84.4
9	Repeat breeder	13262	9017	68.0
10	Deworming	11916	10690	89.7
11	Udder oedema	9567	7993	83.5
12	Wound	6534	5339	81.7
13	Retention of placenta	5744	4094	71.3
14	Bloat	5220	3959	75.8
15	Ectoparasites/ticks	4164	3444	82.7
16	Teat obstruction	4030	2714	67.3
17	Endometritis	3770	3056	81.1
18	Agalactia	2721	2048	75.3
19	Downer	2720	1801	66.2
20	Wart	2573	1802	70.0
21	Lumpy Skin Disease	2258	1693	75.0
22	Swelling/ Joint Pains	1913	1424	74.4
23	Prolapse	1543	1052	68.2
24	Poisoning (unknown origin)	647	448	69.2
	Total EVM Treatment	543745	442337	81.4

Feedback from ABBOTT Private Ltd. - From Feb 2019 to August 2020 on the efficacy of EVPs for 15 clinical conditions in cattle



Sr. No.	Disease condition	No. of animals treated	No. of animals cured	No. of animals not-cured	% cure
1	Mastitis	1165	1087	78	93.34
2	Teat Obstruction	458	416	42	90.74
3	Pox/ Warts/ Cracks	342	281	61	82.24
4	Fever	67	67	0	100.00
5	FMD Mouth Lesions	159	159	0	100.00
6	FMD Foot Lesions/Wound	277	277	0	100.00
7	Bloat & Indigestion	186	175	11	93.95
8	Tick/ Ectoparasite	556	525	31	94.37
9	Worms	1402	1363	39	97.23
10	Diarrhoea	823	785	38	95.37
11	Repeat Breeding	107	62	45	58.00
12	Metritis	4	4	0	100.00
13	Retention of Placenta (ROP)	47	34	13	73.08
14	Udder Edema	285	278	7	97.5
15	Blood in Milk	105	103	2	98.21

ACHIEVEMENT DASHBOARD 2015-16 to 2019-20









Total savings in medicine costs : 2018 vs 2019 Rs.112.4 lakh

Average monthly saving > Rs.8.6 lakh

Above vets 200 trained

Vets from ~40 milk unions across the country (including 12 from Gujarat) trained at the union

82% cure rate of EVM for mastitis from ~75,000 cases documented

86% cure rate of EVM for other ailments from ~1,55,000 cases documented



Intervention Impact study

Antibiotic residue in the milk from Market samples



Market sample	<u>β-lactam</u> group & Sulphonamide	Sulphonamide alone	Gentamicin	Tetracycline
36 brands of milk	24	10	1	1
2 samples does not have Antibiotic residue (Amul Taza & Swastic milk)	0-3 PPB is negative 4-10 PPB is positive	0-10 PPB is negative 15 PPB > Positive	0-50 PPB is negative 50-75 PPB LP 100-200 PPB Positive	0-80PPB Negative 80-100 PPB LP 100-120 PPB Positive
Codex Alimentarius International food standard (MRL)	4 PPB	25 PPB	200 PPB	100 PPB

Antibiotic residue: Farmer Sample After one year intervention (Quinol. Genta, Tetra & Sulpha – Absent)



MILK Union	Number of	Beta lactams	Beta lactams	Beta lactams	
	farmers	Negative	Low Positive	Positive	
Allapra	15	12	2	1	
Arakkapady	15	11	2	2	
Chakkampuzha	10	10	0	0	
Maneed	10	7	3	0	
Manikyamangalam	15	12	2	1	
Monippally	10	6	2	2	
Puthrika	10	10	0	0	
Sreemoolanagaram	15	15	0	0	
Thirukanurpatti (TN)	20	20	0	0	
Aralumallige (Karnataka)	20	20	0	0	
Total	140	123	11	6	
Percentage of farmers		87.86%	7.85%	4.29%	



We also tested for the presence of, Streptomycin, Neomycin, and **Chloramphenicol in the milk but** they were absent in all the samples tested



Cost in Rs. for the treatment of various clinical conditions in cattle using veterinary drugs and herbal formulations

Disease conditions	Number of animal treated	Average expenditure for vet service.	Average expenditure for EVP Rs	Amount saved in Rs
Mastitis	35	3000	120	2880
Maggot wound	28	962.5	60	881.7
Bloat& Indigestion	34	719.4	224	495.4
Repeat breeding	23	3060.7	430	2631
Cow pox	18	583.3	335	250
FMD	22	3165	1640	1525
Diarrhea	3	500	166	334





Repeat Breeding cases treated by EVM								
Total no. of cases recorded	Total no. of Cases treated with EVM	Animals calved after EVM	Animals conceived, at various stages of pregnancy	% animal conceived				
532	532	385	135	97.74 %				

Cost effectiveness in comparison to antibiotics :-

Over all treatment cost of Repeat breeding cases by EVM is about Rs.50/- to Rs.75/-

While the treatment cost by antibiotics is about Rs.1000/- to Rs.1500/- with no guarantee on conception.

Reduction of disease incidence from 2016 to 2019

Disease	ľ	Mastitis		E	Interitis	5	Repe	at breed	ing	(Cowpo	(
Year	2016	2018	2019	2016	2018	2019	2016	2018	2019	2016	2018	2019
Average per union	65.63	36.5	10.6	11.3	7.38	4.38	8.75	2.5	0.38	2.38	2.13	0
Per cent reduction		44.4	83.8		34.7	81.2		71.43	95.7		10.5	100

International collaboration



• Foundation for Natural Livestock Farming (NLF) Partners in Netherlands, Ethiopia and Uganda





International collaboration: Ethiopia

International collaboration: Ethiopia

- 60% reduction of calf mortality
- 50% increase in milk production
- 33% increase in farm income (including 20% cost reduction for cattle health)
- Improved milk quality: 8% antibiotic residue reduction, improved general content (fat, protein, lactose, solid non-fat and density
- 50% and 30% reduction of *E-Coli* and *Staphylococcus aureus* respectively in the milk







- 1. Andhra Pradesh
- 2. Assam
- 3. Delhi
- 4. Gujarat
- 5. Hriyana
- 6. Karnataka
- 7. Kerala
- 8. Maharashtra
- 9. Punjab
- 10. Sikkim
- 11. Tamil Nadu
- 12. Telangana
- 13. Utter Pradesh
- 14. West Bengal



What India can share with others

- Train on documentation of EVP and resources, and validation of EVP
- Train stakeholders on use of herbal medicine on Livestock primary health care and reduce antimicrobial residue in the animal products
- Establish Home/institutional herbal gardens
- Pilots with herbal remedies



Organizational garden - Milk Union



by a farmer



























Training and capacity building of farmers and other stakeholders







Zoonoses & One Health





One health genomics - why animal diseases matter for human health

Dr Chris Rands, Dr Sobia Raza and Dr Leila Luheshi August 2015

http://www.phgfoundation.org/briefing_notes/42 2/

Zoonoses & One Health







Dairy Dynamic Management

- Is a One Health management approach to dairy production medicine with the premise that food safety and milk quality begin on the farm
- This approach incorporates the One Medicine/One Health philosophy and can be implemented to address the previously discussed challenges in food safety.



"One Health" approach

• This seemingly unrelated industry presents an avenue for antibiotic residues to enter the dairy farm impacting food safety, human and animal health, and highlights the importance of a "One Health" approach to animal production.



Antibiotic residues

- Overlooked sector of antibiotic residues remains commercial ethanol production.
- Corn-based ethanol is produced in a fermentation process using <u>yeast cultures</u>.
- These cultures are often contaminated with <u>Lactic Acid</u> <u>Bacteria</u> (LAB), which compete for nutrients and result in lost yield of ethanol.
- In order to prevent proliferation of bacterial contaminants and limit yield losses, many ethanol producers use large amounts of antibiotics in the fermentation process.



Cause for concern

- Residual corn mash and slurry is sold as an animal feed, mainly to beef and dairy producers.
- Antibiotic residues in animal feed has recently become a concern and the dearth of scientific information on how these residues alter the microbiome of economically important agricultural animals is unknown.

ENTERING



LEAVING

Dairy Products Feed Milk Hay Butter Grain Cheese Forage Whev DAIRY Supplies Animal Products **Pharmaceuticals** Beef PRODUCER Equipment Carcasses Disinfectants Replacement Heifers IXIX Waste Water Manure Drinking Water Cleaning **Pharmaceuticals**



The promise of EVP

- Indian knowledge systems represents a systemic theory of biological change and it complements molecular biology.
- It has a history of an extensive veterinary treatment system.
- Today it makes sense to research ancient knowledge and bring out a natural and side effect free treatment for our livestock.



Future solution for the global concern

 Network pharmacology, combinatorial chemistry, pharmacogenomics and trans-disciplinary frameworks that combine EVP, Mrug Ayurveda and western pharmacology are the future solution for the global concern about chemical residues in animal products and AMR





 Adopting the Ethno-veterinary science and practices to combat infectious and other diseases in livestock has been identified and tested as a key game changer in reducing the use of antimicrobial and other chemical drugs in veterinary practices




- Once in a herd, the disease is very difficult to eradicate due to subclinical infections and the presence of insects capable of spreading the virus.
- Clinical signs include: Firm raised skin nodules up to 50mm in diameter develop around the head, neck, genitals and limbs.
- ICAR have developed an indigenous vaccine for <u>Lumpy Skin Disease in cattle</u> which has spread across many States in the last few months.





Ethnoveterinary formulation by prof.punniamurthy for



1

For oral administrations

Garlic

Shallots

First Preparation

Ingredients: (For one dose) Take 10 betel leaves; 10 g black pepper; 10 g salt and blend to form a paste with jaggery

- Feed the dose in small portions orally.
- Feed one dose every three hours for the first day. (Day 1)
- Feed three doses daily from the second day

onwards for 2 weeks. (Day 2 onwards)



Second Preparation Ingredients: (For one dose)

Garlic – 2 pearls; Coriander- 10 g; Cumin-10 g; Tulsi-1 handful; Dry cinnamon leaves-10 g; Black pepper-10 g; Betel leaves- 5 no.s; Shallots- 2 bulbs; Turmeric powder- 10 g; Chirata leaf powder-30 g; Sweet basil-1 handful; Neem leaves- 1 handful; Aegle marmalos (Bel) leaves-1 handful; Jaggery- 100 g

· Feed the dose in small portions orally.

Feed one dose every three hours for the first day. (Day 1)
Feed two doses daily in the morning and evening from the second day till condition resolves. (2 day onwards)





LSD

















Contine Contine















Thank You