

Ethno-veterinary practices adopted during an epidemic outbreak of Foot and Mouth Disease among cattle in Sirkazhi and adjoining villages of Nagapattinam district of Tamil Nadu, India

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ABSTRACT

Background: Foot and Mouth Disease (FMD) outbreak occurs annually among cattle in Tamilnadu, however increased morbidity and mortality was reported in the year 2013 despite preventive measure by the Department of Animal husbandry. Siddha System of medicine is popular and extensively practiced in Tamilnadu. **Objective:** To understand the Ethno-veterinary practices adopted during an epidemic outbreak of Foot and Mouth Disease among cattle in several villages of Nagapattinam district in the month of December 2013. **Methodology:** Cattle farmers were interviewed using a semi-structured questionnaire to capture details on number of cows owned, number affected, presenting signs and symptoms, interventions done, details of person who treated, details of medicines administered including external medicines, dose and duration, outcome of treatment and economic impact during the second fortnight of December 2013 along with photo documentation wherever required. **Results:** Institutional Ethno-Veterinarian's herbal intervention had a marginal edge over the traditional healers intervention both in adult cattle and in calves. The time of commencement of treatment was critical, the failures mainly attributed to late intervention, especially when the cattle were severely affected. Average mortality rate due to the outbreak stood at around 9% among adults and 27% among calves and average loss in productivity stood at Rs. 690/- per cow. Ethno veterinary intervention was found to be significantly associated with good prognosis and survival (P value is 0.00001 significant at P<0.05). **Conclusion:** Early intervention with herbal drugs may be preventive of mortality and may also be protective from development of disease.

Key words: Cattle farmers, Epidemic, Foot and mouth disease, Herbs, Morbidity, Mortality and Economic impact, Traditional intervention

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INTRODUCTION

Foot and Mouth Disease (FMD) outbreak occurs annually among cattle in Tamil Nadu, which directly affect the milk production and in turn causes economic loss to the cattle growers. Loss of life occurs among cattle particularly in calves. Department of Animal husbandry on a regular basis carries out preventive methods including vaccination. But increased morbidity and mortality due to FMD was reported in the year 2013.

Foot and mouth disease (FMD) or *Aphthae epizooticae* is a

highly contagious disease caused by a virus of the genus Aphthovirus, family Picornaviridae. All the seven of its serotypes can affect cloven - hoofed animals both domestic and wild. Foot and mouth disease Virus (FMDV) types O and Asia 1 are Indian origin,^[1] Serotype 'O' is claimed to

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be responsible for 85% outbreaks followed by serotype 'A' 8-10% and rest by Asia 1.^[2] Infection with any one serotype does not confer immunity against another.^[3] Siddha system of medicine, part of Dravidian civilization is the oldest known treatment system widely practiced in south India especially Tamil Nadu. Mattuvagadam is a popular treatise on indigenous management of diseases among cattle. Ethno-veterinary is inexpensive as it involves locally available plants. The study was done with an objective to explore the extent and significance of ethno-veterinary intervention for Foot and mouth disease in Sirkazhi district of Tamil Nadu, India and to evaluate the morbidity, mortality and economic implications related to the outbreak.

METHODOLOGY

Area of study

There was outbreak of FMD among the cattle of Kidarankondan block in Sirkazhi Taluk of Nagapattinam district in Tamil Nadu, India (which is considered to be the origin of the outbreak) during late October of 2013. This epidemic extended to the entire Sirkazhi and Kollidam block and through the adjoining blocks, spread to the neighboring districts too. Therefore the study covered the four blocks namely Sirkazhi, Kollidam and Sembanarkoil blocks of the Sirkazhi taluk and Mayiladuthurai block belonging to the Mayiladuthurai taluk, in order to understand the Ethno-veterinary practices adopted during an epidemic outbreak

of Foot and Mouth Disease among cattle and in Sirkazhi and adjoining villages of Nagapattinam district of Tamil Nadu, India, in the month of December 2013 with the help of field office of the Centre for Indian Knowledge System, an NGO working in the area.

To obtain a representative data the study area was divided based on directions. Three villages each from central, south, west and north directions in such a way they represent the area. Twelve villages were surveyed. Samples (cattle owning farmers) five each from selected villages were randomly selected and interviewed. Villages where case reporting was low and villages in the east which are primarily fishing villages with less cattle population were excluded.

The divisions made for the study purpose is illustrated in Figure 3. North comprised mainly of Kollidam block Achalpuram and Koothiyampettai and Pattavalagam (just above Arasur) Sirkazhi block. Central comprised of Kollidam (Kathiruppuand Arasur) and Thennankudi (Agani) of Sirkazhi. Alaveli, Pagasalai in Semmbanarkoil block and Dharmanathapuram of Mayiladuthurai formed the west, while Kidaramkondan and Arupadhi of Semmbanarkoil block and Radhanallur of Sirkazhi formed the south.

Note: States and the union territories of India are divided into districts. Each district is further divided into sub-districts, which are known differently in different parts in the country (e.g., tahsil, taluka, community development (CD) block, Police station, Mandal, revenue circle, etc.)^[4]



Figure 1: Tamil Nadu state

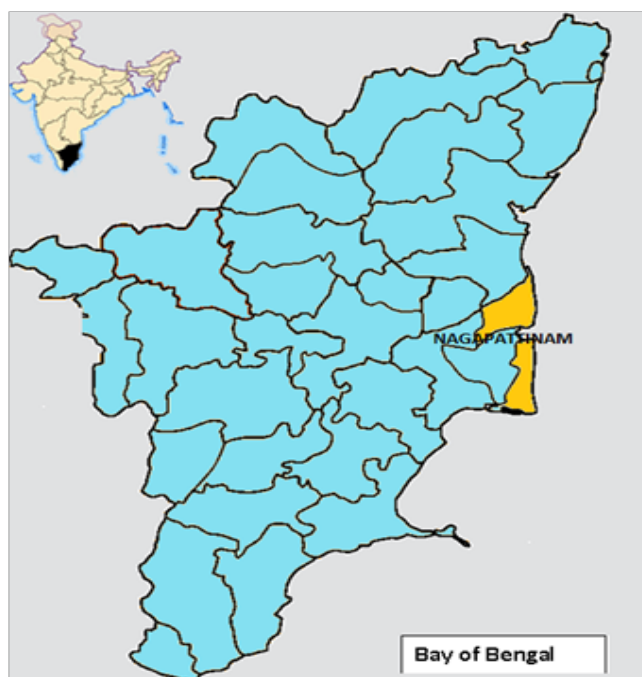


Figure 2: Nagapattinam district in Tamil Nadu

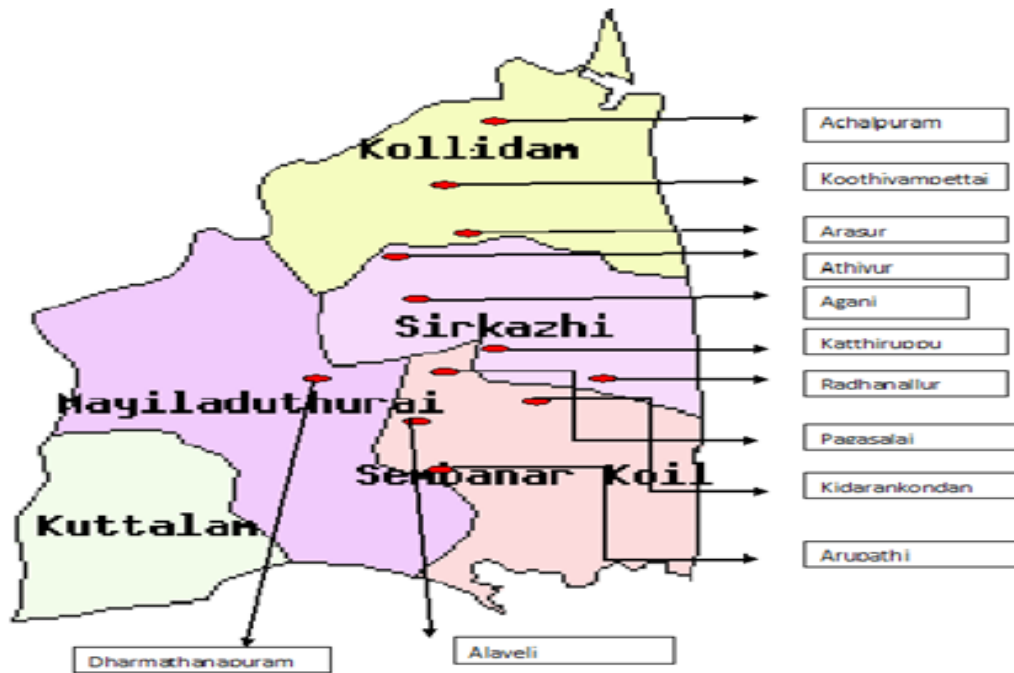


Figure 3: Study area-Illustrative purpose not to scale

Identifying FMD cattles

Disease description and sequel

Aphthae epizooticae or Foot and mouth disease (FMD),^[3] transmitted by aerosol, air and infected fomitus. The incubation period is 3-8 days and the course of the disease ranges from 2-3 weeks with high morbidity rate up to 100 % and mortality rate 0.2-5 % in adults and up to 50% in calves.^[5] The earliest clinical signs are short fever 40-41°C accompanied by dullness, anorexia, cessation of rumination, weight loss, poor growth and a marked drop in milk production, acute painful stomatitis appears causing severe ropy salivation and characteristic smacking of the lips. Then characteristic vesicles of 1-2 cm in diameter, thin walled contain straw-colored fluid appear on buccal mucosa, tongue, dental pad, and muzzle. Similar vesicles appear on the feet especially in the inter digital space and the coronary band causing marked lameness.

Vesicles also may appear on the udder and teats, which predispose to mastitis which easily ruptured within 24 hours, leaving a raw painful surface, which heals in about 1 week, unless complicated by secondary bacterial infection. The common sequels in cattle are myocardial degeneration and deaths in calves, sloughing of the claws, mastitis, abortion, and panting.

Disease Classification

The disease classification is based on the signs and

symptoms of the disease as reported by the respondents during the field study.

Severe: High fever (40-41°C), frothy discharge from mouth, stops feeding, blisters and ulcers with discharge in mouth, tongue, nose, udder and foot, thick coating of the tongue, which at times peels off of to reveal badly ulcerated tongue and cattle is weak to stand and is emaciated, heat emanates when the cow opens its mouth. Maggot infestation of ulcers is common. There may be bleeding from ulcers occasionally.

Moderate: High fever, Frothy discharge from mouth, feeds less, blisters and ulcers with discharge in mouth, and nose, at times from udder and foot, coating of the tongue. The cattle is weak and loses weight.

Mild: Fever, Drooling, reduced feed intake, ulcers in tongue, nose and foot

Data collection

The study was designed to visit personally and interview the cattle farmers in the epidemic hit area randomly with the help of a semi structured questionnaire which would broadly cover the number of cows owned, number affected, presenting signs and symptoms, ethno-veterinary interventions, dose and duration, outcome of treatment and economic impact. All cattle farmers of the district excluding the coastal belt formed the target population for the study, immaterial of whether their cattle was affected or not. The Veterinary surgeons, traditional healers, village heads, NGO which organized free cattle medical camps

Table 1: Sex and age distribution of Cattle

Direction	Adult cattle		Calf		Total
	Female	male	Female	male	
South	41	0	18	2	61
Central	59	0	18	7	84
West	56	9	19	2	86
North	51	0	20	6	77
Total	207	9	75	17	308

Table 2: Vaccination coverage

Status	North	West	Central	South
Vaccinated	40	33	24	31
%	51.95%	38.37%	28.57%	50.82%
Not vaccinated	37	53	60	30
%	48.05%	61.63%	71.43%	49.18%
Total	77	83	84	61

Table 3: Association between vaccination and prognosis

Status	Survived	Succumbed	Total
Vaccinated	107	22	129
Not Vaccinated	147	32	179
Total	254	54	308

were also interviewed in the second fortnight of December 2013. Photo documentation was also done to document sick cattle, application of questionnaire, hoofs, mouth and nose of affected cows and healthy umblachery cattle.

The farmers was orally explained the purpose of the interview. If the farmer/cattle owner was willing to participate, he/she was interviewed and the participant was asked to sign the questionnaire as mark of informed consent. The Structured questionnaire contained information on Ages sex information on cattle (Table-1) vaccination status coverage (Table-2) Vaccination and prognosis relationship (Table-3) formulation for treatment of institutional veterinarian (Table 4 and 5) and of the traditional healer (Tables 6-11) effectiveness of treatment in Table12. The interview was done on one to one basis to avoid reporting bias.

An adult female that has had a calf (or two, depending on regional usage) is an adult cow. A young female before she has had a calf of her own and is under three years of age is called a calf. A young female that has had only one calf is occasionally called a first-calf. Young cattle of both sexes are called calves until they are weaned. Negligible populations of adult cows were noticed owing to modern farming practices and propagation through artificial insemination.

Table 4: Formulation-1 Institution recommended ethno veterinary intervention

Vernacular name	English name	Quantity	Properties relevant
Mutriyathengai	Coconut <i>Cocos nucifera</i>	1 full As gratings	Cooling agent ^[6]
Seeragam	Cumin seeds <i>Cuminum cyminum</i>	50 gms	Carminative ^[6] Cures diseases of mouth ^[6] Astringent ^[6] Nutrient ^[6] (along with palm jaggery) Digestive ^[6] Appetizer ^[6]
Vendhayam	Fenugreek seeds <i>Trigonella foenum-graecum</i>	30 gms	Anti pyretic ^[6] Nutritive ^[6] Demulcent ^[6] Astringent ^[6] Tonic ^[6]
Manjalathool	Turmeric powder <i>Curcuma aromatica</i>	10 gms	Carminative ^[6] Stimulant ^[6] Liver tonic ^[6] Controls excess nasal secretions ^[6]
Panaivellam	Palm Jaggery <i>Borassus flabelliformis</i>	20 gms	Tridoshha Balancer Antipyretic ^[6]
Poundu	Garlic <i>Allium sativum</i>	4 cloves	Heals small boils and blisters ^[6] Cures diseases of the mouth ^[6] Carminative ^[6] Stomachic ^[6] Alterative ^[6]

Table 5: Formulation-2 Institution recommended ethno veterinary intervention

Vernacular name	English name	Quantity	Properties relevant
Kuppaimeni	Indian acalypha <i>Acalypha indica</i>	100 gms	Anodyne ^[6] Anthelmintic Kills maggots (worms in sores) ^[6] Heals itching and wounds ^[6]
Poondu	Garlic <i>Allium sativum</i>	10 cloves	Anthelmintic ^[6] Heals small boils and blisters ^[6]
Manjalpodi	Turmeric <i>Curcuma longa</i>	100 gms	Fragrant ^[6] Heals diseases of the face ^[6] Controls excessive nasal discharge ^[6] Detergent ^[6] Heals wounds, itching, allergic skin conditions ^[6]
Illuppaiennai	Oil of <i>Madhuka longifolia</i>	250 gms	Heals ulcers and sores of the foot ^[6]

Table 6: Formulation- 3 Folk knowledge

Vernacular name	English name	Properties relevant
Maruthaniillai	Lawsonia inermis	Astringent ^[6] Detergent ^[6] Deodorant ^[6]

Expenditure calculation

Average expenditure per cow towards management of FMD was calculated based on the amount claimed to be spent by the respondents on each cow with respect to the severity of the disease. Total expenditure for the cattle based on severity was then divided by the number of cattle included in that category.

Loss of Productivity calculation

Some of the respondents gave milk to co-operative society or private milk marketing agencies in return for cash. In our study milk from 186 cows was sold. This difference in the income (loss) was divided by the 186 (number of cows who’s milk was sold) and the average loss per cow due to drop in milk production was calculated.

Data analyses

The data thus collect was analyzed using Microsoft excel 2007 and online statistical calculator [<http://www.socscistatistics.com/tests/chisquare/Default2.aspx>].

Qualitative data given in frequencies and percentages are age and sex distribution of the sample, vaccination coverage, coverage of ethno-veterinary remedies, morbidity and mortality in relation to vaccination and ethno-veterinary intervention. Prognosis of FMD in relation to vaccination and ethno-veterinary intervention was analyzed using Chi Square test (χ^2).

P value less than 0.05 was considered to be significant.

Quantitative data given in average at 95% confidence interval are Overall Mortality rate, area-wise mortality rate among adult and calf, Survival rate following ethno –veterinary intervention, expenditure in relation to severity of the disease and loss of productivity due to this outbreak.

RESULTS

Total cattle farmers identified and included for the study was 60 and they owned 308 cattle in all.

North–Mainly consists of Kollidam block, Central Arasur and Sirkazhi, West Mayiladuthurai district and Semmbanarkoil block and South Semmbanarkoil and southern part of Sirkazhi block.

Of the 216 adult cattle 207 were female accounting for 95.83%, even among the 92 calves 75 were female, 81.5%.

FMD is a vaccine preventable disease and the survey presents the vaccination status of cattle in the project area The above chart shows that vaccination did have significant impact on preventing the incidence of FMD in this particular outbreak.

Chi square statistics is $\chi^2=0.035$ P value is 0.8513 not significant at $P<0.05$.

Level of significance is 0.05, Degree of freedom 1.

Out of the 60 cattle farmers, 59 resorted to some form of ethno-veterinary practice, institution and or healer guided and hearsay remedies. The commonly practiced Ethno-veterinary managements are tabulated with the corresponding results.

Preparation: Grind and make a paste of ingredients 2, 3, 4 and 5 blend the paste with coconut gratings and feed a cow. (Some villagers also included Garlic for prevention

Table 7: Formulation-4 Folk knowledge

Vernacular name	English name, quantity	Properties relevant
Pandrinei	Pig's fat Susindicus hog (wild), 300 gm	Demulcent ^[7] Emollient ^[7] Laxative ^[7]
Monthan vazhaipazham	<i>Musa paradiseaca</i>	Demulcent ^[6] Laxative ^[6] Nutritive ^[6] Emollient ^[6]

Table 8: Formulation-5 Folk knowledge

Vernacular name	English name	Properties relevant
Pandrinei	Pig's fat Susindicus hog	Heals ulcers ^[7]

Table 9: Formulation-6 Folk Knowledge

Vernacular name	English name, quantity	Properties relevant
Marundhu Karpooram	<i>Cinnamomum camphora</i> , 10 gm	Useful in high fever ^[7] heals ulcers and diseases of the face ^[7] Coolant ^[7] Useful in cardiac ailments ^[7]
Manjal podi	Turmeric <i>Curcuma longa</i> , 10 gm	As in formulation-2
Veppennai	Neem oil <i>Azadirachta indica</i>	Anti septic ^[6] Insecticide ^[6] Heals ulcers ^[6] Antipyretic ^[6]

Table 10: Formulation-7 Folk knowledge, Traditional Healer's recommendation

Vernacular name	English name	Properties relevant
Kambu koozh	Pearl millet <i>Holcus spicatus</i>	Coolant ^[6] Tonic ^[6] Demulcent ^[6] Nutrient ^[6]

Table 11: Formulation-8 Folk knowledge

Vernacular name	English name	Properties relevant
Kezhvaragu koozh	Finger millet <i>Eleusine coracana</i>	Astringent ^[6] Nutrient ^[6] Vadhapithasamani ^[6]

of disease).

Dose: Twice a day Duration: At least 3 days

Procedure: Wash foot with water mixed with turmeric powder and salt and drying it with clean cloth and apply above medicine over the ulcers.

The most used traditional management was based on Institutional veterinarian from the department of ethno veterinary medicine, Tamil Nadu University of Veterinary

Table 12: Effectiveness of herbal remedies

Formulation	Treated		Survived		Survival rate in%	
	Adult	Calf	Adult	Calf	Adult	Calf
1,2,9	185	76	175	58	94.59	76.32
3	157	65	149	53	94.90	81.54
4	12	6	10	3	83.33	50.00
5	26	8	22	7	84.62	87.50
6	113	46	107	35	94.69	76.09
7	54	20	52	17	96.30	85.00
8	32	13	30	12	93.75	92.31
1alone	90	43	84	34	93.33	79.07
9	16	7	13	4	81.25	57.14

and Animal Sciences (TANUVAS) (185 adults and 76 calves). It was found to be successful in 94.59% among adults and 76.32% calves. The time of commencement of treatment was critical, the failures mainly attributed to late intervention, especially when the cattle were severely affected.

Preparation: Water boiled with Law Sonia inermis leaves, cooled and used to wash the ulcers twice a day. Water boiled with Law Sonia inermis leaves was popularly used (73%) for washing ulcers after Potassium Permanganate solution, and was found to be effective in 95% of adults and 85% calves. Preparation and Procedure: Banana is slit and pigs fat is applied to the slit surfaces and is fed to the affected cattle. Pig fat alone was also used.

Pigs fat was found to be effective in 84% of adults but was more effective when given with monthan banana for calves 87.5% and 50% with and without banana respectively.

Applied externally on the ulcer using a feather found to be effective in 85% of 34 cases

Preparation and application: Powder camphor, mix with turmeric powder add enough neem oil to form a uniform paste and apply over the worm infested ulcers.

A mixture of camphor and turmeric powder with neem oil was applied on worm infested ulcers of 113 adult and 46 calves 95% and 76% of cow and calves respectively, worm fell off and ulcers healed in an average of 2 weeks time.

Preparation and administration: Seeds are washed semi dried and ground to powder and a porridge is made, when cool further liquefy with water and fed the affected cow More than 96% cows and 85% of calves which fed on Pearl millet porridge (Kambankoozh) survived the infection.

Preparation and administration: Dry ground flour of the seeds is mixed with water and required salt left to ferment overnight, open cook broken rice when semi cooked add fermented ragi flour cook well, cool add more water and

Table 13: Traditional Healer's preventive medicine for 100 cows (Masala Urundai)

Tamil name	Botanical name	Quantity	Part used
Siruthumbai	<i>Leucas aspera</i>	250 gms	Whole herb
Veeli	<i>Cadaba fruticosa</i>	250 gms	Leaf
Aavaram poo	<i>Cassia auriculata</i>	250 gms	Flower
Thuthilalai	<i>Abutilon indicum</i>	250 gms	Leaf
Sootrukatrazhai	<i>Aloe vera</i>	250 gms	Succulent leaf
Koyya	<i>Psidium guajava</i>	250 gms	Leaf
Perunthummbai	<i>Anisomeles malabarica</i>	250 gms	Leaf
Kozhinji	<i>Tephrosia purpurea</i>	250 gms	Leaf
Kuppaimeni	<i>Acalypha indica</i>	250 gms	Leaf
Pirandai	<i>Cissusquadrangularis</i>	250 gms	stem
Manjanathi	<i>Morindatinctoria</i>	250 gms	Leaf
Virali	<i>Dodonaea viscosa</i>	250 gms	Leaf
Kandangathiri	<i>Solanum xanthocarpum</i>	250 gms	Whole plant
Adathodai	<i>Adhatodavasica</i>	250 gms	Leaf
Aduthinnapalai	<i>Aristolochia bracteolata</i>	250 gms	leaves
Pala	<i>Artocarpus integrifolia</i>	250 gms	Leaf
Maa	<i>Mangifera indica</i>	250 gms	Leaf
Vilvam	<i>Aegle marmelos</i>	250 gms	Leaf
1Arasu	<i>Ficus religiosa</i>	250 gms	Leaf
Aal	<i>Ficus bengalensis</i>	250 gms	Leaf
Kasakkamutti*	-	250 gms	-
Kalludan*	-	250 gms	-
Karisalanganni	<i>Eclipta alba</i>	250 gms	Leaf
Mudakkatran	<i>Cardiospermum haicacabum</i>	250 gms	Leaf
Vazhaipoo	<i>Musa paradisiaca</i>	1 kg	Flower
Siryavengayam	<i>Allium cepa</i>	1 kg	Rootbulb
Poondu	<i>Allium sativum</i>	500 gms	Root bulb
Vila	<i>Feroniaelephantum</i>	250 gms	Leaf
Vellam	<i>Saccharum officinarum</i>	500 gms	-
Thodhuvelai	<i>Solanum trilobatum</i>	250 gms	-
Thengai	<i>Cocos nucifera</i>	1	Nut
Chukku	<i>Zingiber officinale</i>	50 gms	Dried rhyzhome
Millagu	<i>Piper nigrum</i>	50 gms	fruit
Omam	<i>Trachyspermum ammi</i>	50 gms	Seeds
Kadugu	<i>Brassica nigra</i>	50 gms	Seeds
Perunjeeragam	<i>Foeniculum vulgare</i>	50 gms	Seeds
Annasipoo	<i>Illicium verum</i>	50 gms	Flower
Perungayam	<i>Ferula assa-foetida</i>	50 gms	Resin
Vendhayam`	<i>Trigonella foenum-graecum</i>	50 gms	Seeds
Kothumalli	<i>Coriandrum sativum</i>	250 gms	Ariel parts
Elakkai	<i>Elettariacardamomum</i>	50 gms	Seed pods
Kirambu	<i>Syzygium aromaticum</i>	50 gms	Flowerbuds
Kasakasa	<i>Papaver somniferum</i>	50 gms	Bark
Milagaivatral	<i>Capsicum annum</i>	1 kg	Dried ripe fruit

Uppu	Sodium chloride	1 kg	Mineral
Pulli	Tamarindusindicus	1 kg	Ripe fruit
Arugampul	Cynodondactylon	500 gms	Grass as whole
Manjalthool	Curcuma longa	500 gms	Powder of dried rhyzhome
Amman pacharisi	Euphorbia hirta	500 gms	Herb
Paalperukki	Euphorbia heterophylla	250 gms	Herb
Kuppaikeerai	Amaranthusviridis	250 gms	Leaf
Murungai	Moringaoleifera	250 gms	Leaf
Saranai	Trianthemadacandra	250 gms	Herb
Neermulli	Hygrophila auriculata	250 gms	Ariel parts
Vettrilai	Piper betle	250 gms	Leaf
Etti	Strychnosnux-vomica	250 gms	Leaf
Mulmurungai	Erythrina variegata	250 gms	Leaf
Moongil	Bombaxmalabarica	250 gms	Leaf
Sangu	Clerodendrum indicum	250 gms	Leaf
Vaagai	Albizia lebeck	250 gms	Leaf
Ponnavarai	Cassia occidentalis	250 gms	Leaf
Semmaigathi	Cassia alata	250 gms	Leaf
Veliparuthi	Pergulariaextensa	250 gms	Leaf
Aththi	Ficus racemosa	250 gms	Leaf
Musumusukai	Mukiamaderaspatana	250 gms	Leaf
Kopuramthangi	Andrographis echioides	250 gms	Leaf
Usulai	Albizia amara	250 gms	Leaf
Thekku	Tectona grandis	250 gms	Leaf
Kottaikarandhai	Sphaeranthus hirtus	250 gms	herb
Manjalkarisalai	Wedelia calendulacea	250 gms	Ariel shoots
Vedimuthu	Ricinus communis	250 gms	-
Narthai	Citrus aurantium	250 gms	Leaf
Elumichai	Citrus medica	250 gms	Leaf
Madhulam	Punica granatum	250 gms	Rind
Agathi	Sesbania grandiflora	250 gms	Ariel shoots
Koeleria*	-	250 gms	-
Naruli*	-	250 gms	Leaf
Semparuthi	Hibiscus rosa-sinensis	250 gms	-
Vembu	Azadirachta indica	250 gms	Ariel shoots
Malaivembu	MeliaAzadirach	250 gms	Ariel shoots
Siriyangai	Polygala chinensis	250 gms	Ariel shoots
Periyangai	Polygala elongata	250 gms	Ariel shoots
Keezhanelli	Phyllanthus amarus	250 gms	Ariel shoots
Marul	Sansevieria roxburghiana	250 gms	Ariel parts
Naikadugu	Cleome viscosa	250 gms	Ariel parts
Nayuruvi	Achyranthes aspera	250 gms	Ariel parts
Nallavelai	Gynandropis gynandra	250 gms	Ariel parts
Ezhuthannipoondu	Launaea acaulis	250 gms	Leaf
Avuri	Indigofera tinctoria	250 gms	Ariel parts
Nettilingam	Polyalthia longifolia	250 gms	Ariel shoots
Ilavam	Ceiba pentandra	250 gms	Leaf

<i>Inbura</i>	<i>Oldenlandia umbellata</i>	250 gms	Ariel parts
<i>Paruthi</i>	<i>Gossypium hirsutum</i>	250 gms	Leaf
<i>Sarakondrai</i>	<i>Cassia fistula</i>	250 gms	Leaf
<i>Chappathikalli</i>	<i>Opuntia vulgaris</i>	250 gms	Leaf
<i>Thulasi</i>	<i>Occimum grattismum</i>	250 gms	Leaf
<i>Ponnamkanni</i>	<i>Alternanthera sessilis</i>	250 gms	Leaf
<i>Vasambu</i>	<i>Acoruscalamus</i>	250 gms	Dried rhyzhome
<i>Thippili</i>	<i>Piper longum</i>	250 gms	Dried fruit
<i>Kopurakattrazhai</i>	<i>Aloe barbadensis</i>	250 gms	Leaf

*To be identified

feed the affected cow.

Finger millet (Ragi koozh) too was effective in more than 93% cases of adult cows and 92% calves.

The following Table 12 presents the effectiveness of different coded herbal remedies, the details of which are provided in the Annexure.

Traditional Healer who camped in and around Sirkazhi treated 106 adults and 50 calves of the samples studied. Survival rate was found to be 87.29% and 68.11% for adults and calves respectively. His remedy masala urundai Formulation-9 consisted of locally available antiviral, anti-inflammatory, nutritive, antipyretic, antihelminthic and cooling herbs. Table 13 is the index of hundred herbs used in this preparation. Below Figure 6 shows the healer preparing masala urundai for feeding all cattle of that area, whether affected or not, with the help of local residents.

Chi square statistics is $\chi^2 27.69$ P value is 0.00001 significant at $P < 0.05$

Level of significance is 0.05, Degree of freedom 1. Hence herbal management is associated with very good survival chances.

Morbidity and Mortality

The study covered the mortality of animals classifying them based on sex and age and the expenditure involved in treating the condition and is given in Tables 14 and 15. The details loss of productivity is given in Table 16.

Average mortality rate due to the outbreak stood at around 9% among adults and 27% among calves. The highest mortality rate of 45% was found among calves of Sirkazhi south (Sembanarkoil block) followed by 34% calves of Sirkazhi west and lowest 0% among cows of Sirkazhi north.

Morbidity and expenditure in relation to severity of disease

The disease classification is based on the signs and symptoms of the disease as reported by the respondents during the field study, only 275 cows which could be distinctly grouped were considered for this table.

The average expense for a severely affected cow was found to be around Rs. 1378/- for a moderately affected cow Rs. 1092/- and that of a cow with mild disease was Rs. 366/- This table shows the income generated by 186 cows for which the data could be obtained, before and after FMD. Average loss in productivity stood at Rs. 690/- per cow, as milk from 186 cows were given to societies and co-operatives in exchange to cash

The values reflect the approximate income before and after FMD as reported to us by the respondents during the survey.

DISCUSSION

The cattle population consisted of more than 95% of female adults and among calves 74% of female (Table 1). Propagation of species was exclusively through artificial insemination. The male calves were sold early for meat to neighboring states especially Kerala. Most the cows were cross breeds for better milk yield. Most of the farmers owned Jersey cows, which were cross bred with Holstein Friesian (HF) variety. The milk yield is 20 litres/ day, 8-10 liter per day and 10-15 liter per day for Jersey, Jersey country cross and HF country cross respectively.^[8] The country cows were the least affected by the outbreak. The Veterinary Assistant surgeon mentioned Country breed Umblachery found in the Tanjavur region of Tamil Nadu is best suited for Nagai district.^[9] But they are poor milk yielders.^[10]

The total mortality rate among adult cattle was found to be 8.55% and 27.5% among calves and the mortality rate is in line with mortality statistics from 2002 to 2008 in Erode, 17.1% in adults and 26.8% in calves due to FMD.^[11] The Ponsel village in south west of Sirkazhi is believed to be the entry point of the epidemic. The Southern western part of Sirkazhi which included the worst affected Sembanarkoil block shows the highest mortality among calves with 45% (Table 15) in south followed by west with 33% similar pattern in mortality of adult cows here west leading with 15% followed by south with 12%. The epidemic had set in and taken the toll in this part by the time any sort of

Table 14: Management with oral and external herbal therapy

	Survived	Succumbed	Total
Oral and external HM	248	43	291
No	6	11	17
Total	254	54	308 (N)

mortality and may also prevent development of disease'. Chances of presence of causative virus in the animal's body needs to be ruled out anyway. The efficacy of various formulations irrespective of the time of intervention is shown in Table 14. Interrupting transmission is a challenge in FMD, our study found isolation had helped in preventing the disease in country breed cows only. Transmission

Table 15: Mortality statistics

Direction	Mortality		Mortality rate in %		Total mortality in %
	Adult	calf	Adult	calf	Adult and calf
South	5	9	12.20	45.00	28.6%
Central	4	6	7.00	24.00	15.5
West	10	7	15.00	33.34	24.17
North	0	2	0.00	7.70	3.8
Total	19	24	8.55	27.5	18

Table 16: Morbidity and expenditure in relation to severity of disease

Severity	no. of cattle	No. of death	Expenditure	Average expense/cow
Severe	158	26	217,600	1,377.22
Moderate	68	9	74,300	1,092.65
Mild	49	4	17,950	366.33

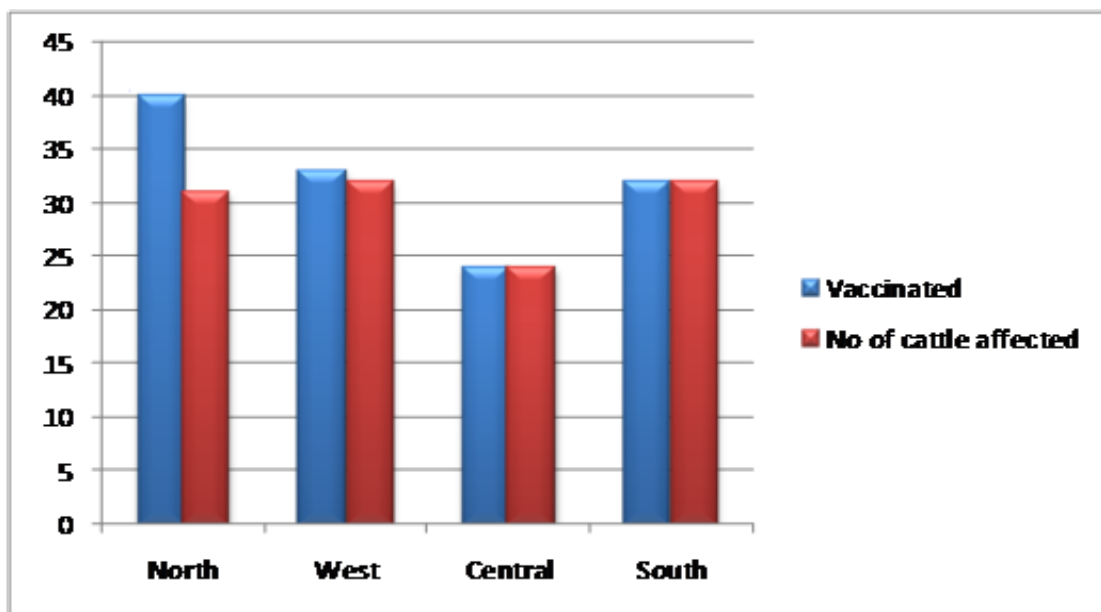


Figure 4: Incidence among vaccinated

intervention could be effectively done. On being aware regarding the outbreak and possible remedies, study area north fared well.

Out of 77 affected cattle 26 were calves, disease was fatal only in 2 calves in the northern part. We could observe

however that the vaccination coverage did not correlate with the morbidity or mortality due to the epidemic (Table 2). Here again judging the exposure is very difficult, timing of vaccination is critical, at least 3 weeks before exposure. From Table 3, 14 and figure 4 we conclude 'Early intervention with herbal drugs seems to be preventive of



Figure 5: Affected hoof



Figure 6: Traditional healer's camp



Figure 7: FMD affected and highly emaciated cow



Figure 8: FMD affected calf

of infection to calves from infected mothers could be prevented by not allowing the calf to consume feeds from its mother and isolating it.

Farmers had to spend Rs 450/- towards consultation and medicines/cattle/visit to private veterinarian apart from bearing their travel expenses. Opportunistic selling of Veterinary drugs like expensive antibiotics, Intra-venous fluids and multivitamins, inflated prices of ingredients required for traditional management doubly impacted the farmers as they stared at loss of revenue from their livestock. Abortion in pregnant animals, reduction in meat production and drop in milk production caused direct loss, Loss of milk yield on a permanent basis can cost ones'

livelihood, loss of breeding capacity including abortions and mortality in young calves due to heart failure affects livestock development. Loss in flesh in meat-animals due to emaciation and loss in cattle trade both national and international (WTO) impacts beyond the farmers. To ensure safe disposal of carcass farmers had to shell out for mechanized cremation. Table 16 and 17 shows the average expenditure to be around Rs. 1378/- for a moderately affected cow Rs. 1092/- and that of a cow with mild disease was Rs. 366/-. Loss of income/cow for one month or till it becomes productive was found to be around Rs. 690/-. From Table 16 and 17 we conclude the severe the disease bigger the expense and loss of income. Outbreak of FMD

can have a detrimental impact on the rural economy.

The Tamil Nadu Government had made arrangements for the supply of Tribal choornam and mathanthylam through the Siddha wing at District headquarters hospital Nagapattinam after the outbreak. Apart from the herbal remedies these drugs were also given to the affected cattle.

A readily available Siddha proprietary medicine extensively used as external wash to heal ulcers (esp. ulcers of tongue), wounds and other skin problems.

A readily available Siddha proprietary medicine well documented for its wound (all types including gangrene) healing properties.

Early intervention with herbal drugs may be preventive of mortality may also protective from development of disease. The study done with in a limited time frame with a limited sample provided indicators as to the extent of ethno-veterinary practices and its effectiveness in treating Foot and Mouth Disease. Though ethno-veterinary practices has been documented there is little scientific evidence.^[12,13] The ingredients of most widely used ethno veterinary intervention, apoultice containing Cumin seeds *Cuminum cyminium*, Fenugreek seeds *Trigonella foenum-graecum*, Turmeric powder of the dried rhizome *Curcuma aromatica*, Palm Jaggery *Borassus flabelliformis*, Garlic *Allium sativum* and Mature coconut grating *Cocos nucifera* as an internal medicine can be scientifically validated for treatment and

prevention of Foot and mouth disease among cattle. The growing population of cross breeds, the aftermath of white revolution needs to be handled.^[14] The study also shows that more severe the disease, bigger the expense and loss of income. Outbreak of FMD can have a detrimental impact on the rural economy and prevention is better than cure.^[15]

CONCLUSION

This study clearly suggests that early interventions and quarantine measures are really helpful. Native breeds withstand outbreaks of disease much better than and the ethno-veterinary practices both of institutions as well as traditional healers are useful in combating FMD outbreak and spread.

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CONFLICT OF INTEREST

There is no conflict of interest for the Authors.

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