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Management of foot and mouth disease in a dairy farm: By ethnoveterinary practice

RAJEEV RANJAN[1], JITENDRA KUMAR BISWAL[2], AJAY KUMAR SHARMA[3], MANOJ KUMAR[4] and BRAMHADEV PATTNAIK[5]

ICAR-Project Directorate on Foot-and-Mouth Disease, Mukteswar, Nainital, Uttarakhand 263 138 India

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ABSTRACT

Gruel feeding remitted in rapid recovery of foot and mouth disease (FMD) affected dairy cows. The gruel was prepared by cooking equal proportion of whole rice, wheat flour and finger millet flour in adequate quantity of water, jaggery (10%) and mineral mixture. Four organized dairy cattle farms, affected with FMD were selected, where animals at first and second dairy farms were fed gruel @ 2 kg/day for 20 days, at the third dairy farm 2 kg/day/animal for 10 days and in the fourth farm no gruel was given. Wounds were sprayed with 1% $KMnO_4$ solution and then applied with paste of honey (50%, v/v) and finger millet flour. Topical application of honey- finger millet flour paste, remitted in observation of pain relief in cows having tongue lesions and healing of the tongue/mouth wounds in 3 days thereby enabling the cows to resume eating. The per cent drop in milk yield in FMD affected cows in the first, second, third and fourth dairy farms was 85, 67, 45 and 81 respectively, regain by 80– 100 % in the treatment group after 16 to 20 days post infection, while in untreated animals, only 50% milk yield could be achieved at day 30–35 post infection. Therefore, gruel being low cost, locally available and easy to apply at farm level for rapid relief to the affected cows and faster improvement in daily milk yield helps in improving economic status of small, marginal farmers or livestock holders.

Key words: Ethnoveterinary practice, FMD, Finger millet, Honey, Wheat flour, Whole rice

Foot-and-mouth disease (FMD), a highly contagious and economically important viral disease of cloven-hoofed domestic animals and wild ungulates (Biswal *et al*. 2012, Ding *et al*. 2013), is caused by foot-and-mouth disease virus (Racaniello 2001). The disease is endemic in India, which is characterized by high rise of temperature, appearance of vesicles (blisters) on the tongue, muzzle, snout, nose, teats, inter-digital space of hoof and other hairless parts of skin (Teifke *et al*. 2012, Ranjan *et al*. 2014) that results into off-feeding, lameness, and sudden drop in milk yield up to ~80%. There is no specific treatment for FMD. The conventional treatment involves use of antibiotics, flunixin meglumine and mild disinfectants (Radostitis *et al*. 2000). FMD has been managed traditionally by use of natural soda ash solution for washing of the lesions, while some communities have applied honey and even finger millet flour to the lesions (Gakuya *et al*. 2011). These traditional remedies were also reported earlier (Hedge *et al.* 2005, Molan 1992, 2001). Application of cereals and honey for the treatment and control of livestock diseases was also documented in Kenya (Ohta 1984, Illes 1990, Wanyama 1997, 2000, Miaron 2003).

Finger millet *(Eleusine coracana)* including African finger millet and caracan millet (koracan), an annual plant widely grown in different agro-climatic regions. Common vernacular names of finger millet in India are *ragi, kodra, mandia, kayppai, panjipul, maddua, nachani, nagali, nachani*. Finger millet is tasty, with a mildly sweet, nut-like flavour and contains several beneficial nutrients, especially the amino acids likes methionine, lysine, threonine and valine (Ravindran 1991, Sripriya *et al*. 1997). It also contains minerals like iron, magnesium, phosphorous and potassium. In past, millet was used in treatment of sinus and severe cold by applying its paste on forehead of human being. In southern India, paediatricians recommend finger-millet-based food for infants of six months and above because of its high nutritional content, especially iron and calcium, assimilability. In this study, we described the treatment of FMD affected dairy cows.

MATERIALS AND METHODS

Herd history and case studies: Four organized dairy cattle farms where FMD occurred during 2013–14 were taken up in the present study. The third dairy cattle farm

Present address: [1,2,5]Scientist (drrajraj@gmail.com, jkubiswal@gmail.com, pattnaikb@gmail.com). [3]Principal Scientist (sharmaak62@gmail.com). [4]Assistant Professor (drmanojmicro@rediffmail.com), Department of Microbiology, Bihar Veterinary College, Patna, Bihar.

was having 25 crossbred lactating cows of different age groups and affected with FMD. Cattle of this farm was regularly vaccinated against FMD (trivalent FMD vaccine against serotype of O, A and Asia1) twice a year. The last vaccination against FMD virus in this farm was done on 18 October 2013. On 22 October 2013, one adult cow revealed symptoms of FMD. On 24 October 2013, seven cows showed clinical signs of FMD i.e. raise of body temperature to 106–107°F and eruption of vesicles on the tongue and erosion of tongue epithelium. Second dairy cattle farm had 30 crossbred lactating cows of various age groups and were affected with FMD in December 2013. Animals at this farm were never vaccinated against FMD. First case of FMD was identified on the basis of clinical signs and symptoms. On second day, seven new cases of FMD were detected. Third dairy cattle farm was having 40 crossbred milking cows of different age groups and were severely affected with FMD. The fourth dairy cattle farm had 25 milking crossbred cows of different age groups and all cows were severely affected with FMD with 80% drop in milk production. This herd had no history of vaccination against FMD. In all the dairy farms, diagnosis of FMD was made on the basis of clinical signs and symptoms and quick laboratory analysis like FMD virus sero-typing, sandwich ELISA, RT-LAMP and multiplex PCR. In all the 4 dairy farms, FMD virus serotype O was diagnosed.

Management of FMD: After diagnosis within 24– 48 h, the farms were placed under quarantine. The farm premises were disinfected with 4% sodium carbonate in water twice a day. Proper bio-security measures were applied in the farms. All hardware was disinfected with 4% sodium carbonate before entry and exit.

Affected animals were segregated from apparently healthy ones and subjected to treatment. Mouth and tongue lesions were collected for laboratory diagnosis and the wounds were applied with paste of finger millet flour and honey (50%, w/v) in the first, second and third farm. The lesions were inspected daily. Mild antibiotic viz. long acting oxytetracyline @ 20 mg/kg body weight or penicillin-streptomycin @10,000 IU per kg body weight was given only to animals having lesion either on tongue or feet. Teat lesions were also treated with paste of finger millet flour and raw honey (50%) and cases of mastitis were managed with ampicillin and cloxacillin intramammary tubes.

Feeding of gruel to sick animals: Four cattle dairy cattle farms were divided into three groups. First and second dairy cattle farms were kept in group 1 in which there were regular feeding of 2 kg gruel to each infected animal per day till 20 days. In the third dairy (group 2), each animal was fed with 2 kg of gruel per day till 10 days while in group 3 i.e. fourth dairy farm (control group) no gruel supplementation was given. The gruel was prepared by cooking equal proportion of whole rice, broken flour and finger millet flour in adequate quantity of water and then supplemented with jaggery (10%) and mineral mixture.

Daily milk production record: Average daily milk production from all the FMDV infected animals were recorded to assess the effect of the treatment and feeding supplementation on milk productivity regain (Table 1).

RESULTS AND DISCUSSION

In the present study, 4 organized dairy cattle farms having clinical FMD were included. Clinical materials (saliva, blood, tongue and feet epithelium), collected from all the four farms, were found positive for FMDV by mPCR (Giridharan *et al*. 2005) and diagnosed serotype 'O' (Fig. 1).

By topical application of paste of finger millet flour and honey (50%), the mouth lesions healed in 4–5 days and affected animals started taking feed slowly from third day onwards. Honey has been employed for treatment of infected wound as long as 2,000 years ago, even before bacteria were discovered. Antibacterial properties of honey are due to production of hydrogen peroxide, even though the concentration of hydrogen peroxide in honey is little; it is still effective as an antimicrobial mediator (Molan 2001). Honey stimulates monocytes in cell culture to release cytokines, tumour necrosis factor-alpha (TNF-α), interleukin IL-1 and IL-6, which activate the immune response to infection when used at a concentration of 1% (Tonks *et al*. 2001). When honey is used at a concentration of 0.1%, it stimulates proliferation of peripheral blood B-lymphocytes and T-lymphocytes in cell cultures and phagocytes are also activated at same concentration (Abuharfeil *et al*. 1999). Therefore, the mobilization of blood cells which are crucial in the immune response to infection together with the production of hydrogen peroxide, which inhibit microbes, could have contributed to the fast healing of the lesions in this case. Along with honey, finger millet has also wound healing capacity in FMDV lesions (Gakuya *et al*. 2011). Acceleration of dermal wound (incised wound) healing capacity of an aqueous paste of finger millet flour due to increase in protein and collagen contents in the

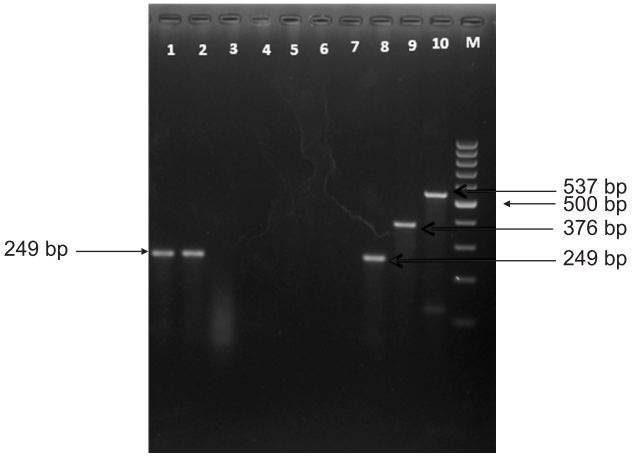

Fig. 1. Agarose gel electrophoresis of multiplex PCR (mPCR) products showing presence of distinct bands of test sample in columns 1 and 2, 249 bp; negative test samples, column 3,4,5,6; negative control, column 7; PC, positive control of O- 249 bp, A-376 bp and Asia 1– 537 bp, column 8, 9, and 10, respectively; M, 100 bp molecular weight marker.

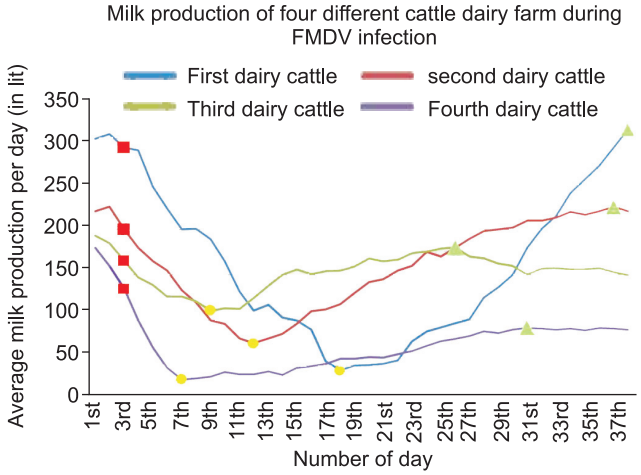

Fig. 2. Average daily milk yields from four dairy cattle farms from two days before reporting the clinical signs and symptoms of foot and mouth disease till 38th days. 2a. red square indicate days on which clinical signs and symptom appeared in animals, yellow circle indicates lowest milk yield during FMD incidence and green triangle indicates the highest milk yield after recover from FMD.

granulation tissue have also been shown in rats (Hedge *et al*. 2005). Present findings justified the traditional usage of honey and finger millet flour in buccal cavity wound management in FMD.

Milk production record from all four cattle dairy farms is shown in Table 1. With the onset of first clinical symptoms of FMD, as reported by the livestock owner to the concerned authority, milk production started decreasing (Fig. 2). Milk production drastically reduced in first, second and fourth cattle dairy farms by 85, 67 and 81 %, respectively, but in third cattle dairy farm milk production reduced only up to 45 % (Table 1; Fig. 2). Loss of milk production in first, second and fourth farm may be due to severity of the disease. This severity of infection is related to vaccination, as in first, second and fourth farm, there was no history of vaccination, whereas in third dairy farm, there was regular vaccination carried at every six month interval with trivalent FMD virus was practiced severity of the lesions was low. In group 1, gruel was fed to all affected animals up to 20 days (Fig. 2) and their cows resumed up to 100 % production after 35th and 32nd day post FMD in first and second cattle dairy farm, respectively. In second group (third cattle dairy farm), gruel was fed only for 10 days to affected cows and the milk production was resumed up to 100 % after 24th day post FMD. In the third group (fourth cattle dairy farm), where the cows were not fed with gruel, the milk yield resumed only up to 50% after 29th day post FMD. Above finding indicates that cows which were fed with gruel regained their milk yield upto normal (yield before FMD) in 25–35 days time. Finger millet act as galactagogue and bestowed with many other medicinal properties (Tiwari and Pande 2010). This justifies the traditional usage of soda ash, raw honey (50%), wheat flour, finger millet flour, whole rice and jaggery for the

Table 1. Average daily milk yield of dairy cattle farm during and after FMDV infection

Group of dairy farm→ Days ↓	First dairy farm	Second dairy farm	Third dairy farm	Fourth dairy farm
1st	300	220	193.1	180
2nd	305	225	184.6	160
3rd	290	200	165.6	135
4th	287	180	147.2	100
5th	247	165	139.1	70
6th	223	155	126.4	48
7th	200	133	126	35
8th	201	120	121.4	36
9th	189	100	111	38
10th	165	96	113.6	43
11th	132	80	113.1	41
12th	111	75	124.8	41
13th	117	80	138.1	44
14th	103	85	150.4	40
15th	100	96	156	48
16th	90	110	151.2	50
17th	55	112	154.3	52
18th	45	118	154.6	58
19th	50	130	159.2	58
20th	51	142	168.2	60
21st	52	145	164.8	59
22nd	56	155	167.2	63
23rd	77	160	174.1	66
24th	88	175	175.6	72
25th	92	170	178.9	77
26th	97	180	180.2	80
27th	101	190	170.4	83
28th	125	198	168	88
29th	136	200	162.5	86
30th	150	202	160	90
31st	180	210	150.5	92
32nd	200	210	156.7	91
33rd	215	213	157.2	90
34th	240	219	156.1	91
35th	255	216	155.9	89
36th	270	220	157.4	92
37th	290	225	152.8	91
38th	310	220	150	90
Reduction of milk production (%)	85	67	45	81

management and control of FMD is supported by the rapid healing of the FMD lesions and improved milk production observed.

In conclusion, ethnoveterinary medicines/practices are

used extensively and quite effectively for primary health care treatment and maintaining animals productive. In present study, ethnoveterinary practice was used for management and control of foot and mouth disease. The traditional usage of soda ash, raw honey, wheat flour, finger millet flour, whole rice and jaggery for the management and control of FMD is supported by the rapid healing of the FMD lesions and improved milk production in the experimental animals to the tune of 80– 90 %, even up to100 in almost all cows affected with foot and mouth disease virus infection. The usage of these ethnoveterinary practices is, therefore, recommended as these products are cheap, locally available and easy to apply at farm level. Such type of ethnoveterinary practice help in improving economic status of small, marginal farmers or livestock holders.

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