

Use of Plants in the Management of Foot and Mouth Diseases in Sheep

Mohd Adil Deva^{1,*}, Jahangirr Ahmad Magray², Sameer Ahmad Thoker¹, Sushil Manderia¹

¹School of Studies in Botany, Jiwaji University Gwalior, India

²Government Model Science College Gwalior, India

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Abstract Foot and mouth disease (FMD) is still a challenge for the world, most particularly for developing countries. The ethno-veterinary science is considered as a viable practice for curing animal disorders in whole world. There is no particular allopathic treatment for foot and mouth disease (FMD) and disadvantages in the use of some prescribed medicines have diverted focus of researchers towards ethno-veterinary sciences. In this study, various locally accessible herbs were chosen for their therapeutic potential to treat sheep foot and mouth illness in Pampore town. Two sheep farms were examined out of which the members of one farm i.e. farm A were fed with plants like *Salix alba*, *Salix babylonica*, *Convolvulus arvensis* and *Brassica oleraceae*, var. *Gongyloides* while the members of farm B as usual were fed with wheat bran and local herbs. Extractions and preparations of these plants were used with a main aim to boost the immune system and to stimulate antiviral functions in animals. The results showed the members of farm A recovered quickly from the disease and had less mortality and abortion rate in comparison to farm B. The observed results documented from this study could be used to manage efficiently viral diseases in future and to improve the lives animals. Evidence from the study revealed the significance of said plants against FMD especially in Kashmir.

Keywords Ethno-Veterinary, Foot and Mouth Disease, Pampore, Sheep, Treatment

1. Introduction

Relationship of millions of people with their livestock is reality across the globe. People depend on them as they provide different products like milk, meat, eggs, food, manure, labor, cloths, cash which act as a storehouse of wealth for a farmer [1]. To keep animals healthy, traditional healing practices have been applied for centuries and have been passed down orally from generation to generation. Prior to the introduction of western medicine, livestock keepers relied on these traditional practices [2]. According to the World Health Organization, at least 80% of the people in developing countries depend largely on these indigenous practices for the control and treatment of various ailments that affect livestock [3].

Foot and mouth disease (FMD) is a highly contagious viral disease which affects most particularly cloven-hoofed domestic and wild animals [4]. This disease affects all breeds of ages of hoofed animals [5]. The causal agent of this viral infection belongs to "picorna" virus group, family picornaviridae. The size of this virus varies from 8-10µm. The disease is endemic to Asia, Middle East, Africa, and South America. FMD virus contains seven serotypes: SAT 1, SAT 2, SAT 3, A, O, C, and Asia 1, with O and A have the most extensively occurrence, SAT viruses are mostly found in Africa while Asia 1 is found in Asia (World Organization for Animal Health 2012). This disease is not so serious for livestock in India, but seldom progresses to

fatal issues which cause severe economic losses round the year.

According to World Health Organization [6], 70% of world population depend on Traditional Health Care System (THCS) to cure various diseases [7], while 80% Indian population have strong conviction on THCS. Kashmir harbors a large number of medicinal plants [8], but most of which have still remained unexplored. Some of these plants have the potential to cure number of diseases that can cause huge fatalities among animals. The present study was conducted to observe the impact of locally available nutritious and medicinal plants during the outbreak of foot and mouth diseases with veterinary prescribed medicines. Some of the plant species which were chosen for the study are as follows:

Salix alba (Local name: Bota vir, Common name: White willow, Family: Salicaceae)

Its fresh and dried leaves are used as fodder to livestock [9]. The plant is famous for the original source of salicylic acid. Salicylic acid is a precursor of aspirin, and is used for thousands of years to manage fevers and relieve joint pain [10]. The plant is used as anodyne and febrifuge [11].



Salix babylonica (Local name: Teth vir, Common name: Babylon or weeping willow, Family: Salicaceae)

The plant grows as medium to large deciduous tree with stout trunk and graceful broad-rounded crown. The branches of the plant sweep downwards to the ground. The branches looped with leaves are used for cattle fodder. Extract of bark extract is used for insect bites curing. The twig is commonly used as Miswak (a local brush) to act as mouth freshener and cleaning of teeth while its sap is used

for curing throat infection and aches [9]. Similar to white willow, the plant is used to treat different ailments such as fever, body pain, headache, respiratory infection, typhoid etc. [12].



Convolvulus arvensis (Local name: Thurae Posh, Common name: Field Bindweed Family: Convolvulaceae)

The plant is commonly known as bindweed, herbaceous, perennial plant. The plant is considered as major weed of crop plants but it has a number of medicinal properties [13]. The root of the plant acts as diuretic, laxative while the leaves are used to cure fever and blisters. Around the world the plant is used for grazing of cattle and Minnesota prefers domestic sheep grazing on field bindweed [14]. Purified leaf extract is used to boost immune system and safer for liver and kidney functions [15].



Brassica oleracea var. *Gongylodes* (Local name: Munje Haakh, Common name Knol-khol, Family: Brassicaceae)



The plant is a cool season and lesser known vegetable. It is also referred as Khol rabi, Ganth gobhi and Navalkol. The knob and leaves are used as vegetable and is harvested for human consumption [16]. The plant is a rich source of vitamin A and C, folic acid as well as dietary fiber. Besides that, it is a rich source of vitamin B-complex and contains good levels of minerals. One of the compound named as sulforaphane is present in the plant which possess anticancer properties. The plant is mild laxative and possesses an anti-inflammatory [17].

2. Materials and Methodology

Study Site

Jammu and Kashmir India is the north most state which lies between 32 °17" and 36 °58N latitude and 73 °26" and 80 °30" longitude. The State is famous for its scenic beauty that paves distinct way for tourism. The current study was carried out at world famous Saffron Town *viz.* Pampore.

Experimental Design

Pampore town is rich in livestock that acts as best asset from financial point of view [18]. Chandhara and Kranchoo are two adjacent villages of Pampore town. The particular outbreak of foot and mouth disease started in the month of May in 2021 in North Kashmir, according to Animal husbandry department Srinagar Jammu and Kashmir. Here in Pampore, the outbreak of FMD took place in the last week of June. The experimental design of this particular study was prepared on 5th of July 2021 when

first cases were reported from two local farmers and are accordingly referred to as case I and case II. The study was carried out for 2 months and during this time period a total of 172 sheep of Case I (115 males and 57 females) and 62 sheep (37 males and 25 females) of Case II were under examination. On the basis of complications and symptomatology, the animals were divided into 5 groups. Group I consists of unaffected animals, Group II consists only pyretic animals with fever, Group III consists of animals with formation of vesicles and blisters in the mouth, Group IV consists of animals with mild lameness. Group V consists of animals with severe lameness. In all situations, the sick animals were given Oxytetracycline intramuscularly based on their weight (10 mg/kg weight) for three days. Melonex⁺ Intas 1.5ml/25 kg body weight for 2-3 days. The animals with mild mouth lesions were treated with local application of Potassium permanganate (1ppm) and boro-glycerine as recommended by Veterinary Department. Feet of animals with lesions were washed with Copper sulphate solution plus Potassium permanganate for 10 minutes and then applied with boro-glycerin. Besides that animals with severe foot lesions, complicated with coronary band and maggot wound were bandaged up after the application of Providin Iodine. There was also a focus on the local application of antiseptic solutions like 2% NaHCO₃, 4% Na₂CO₃ [19]. Besides that the two villagers had chosen two different feeding and keeping patterns for animals.

Case I

The livestock was kept in open cool space. The sheep keeping place was continuously sanitized with the extraction solution of antiseptic prepared from *Allium cepa*. Besides locally available grass, the pyretic animals were also fed with leaves of *S. alba* and *S. babylonica*. The animals with oral mucositis were fed with the aqueous extract of *S. alba*, *S. babylonica* and macerated *Convolvulus arvensis* and leaves of *Brassica oleracea*.

Case II

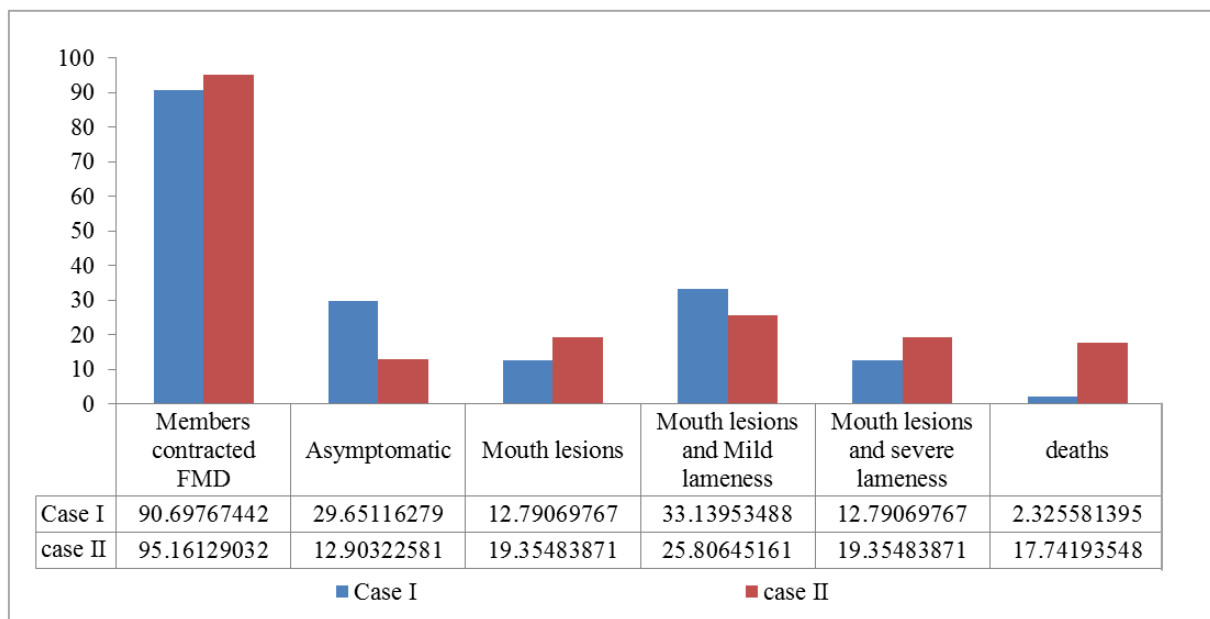
The animals were also kept in open and cool area as in the above case. However these animals were fed with wheat bran and other grass varieties which they used to eat on daily basis.

3. Results and Discussions

The onset of disease in both flocks was reported on 5th of July after consulting the veterinary doctor. They diagnosed the disease on the basis of clinical findings, presumptive history, and abrupt fever. Initially the affected animals showed high fever (40-42 °C) and anorexia.

Table 1. No. of FMD members on the basis of complications

Plots	Total flock	Members contracted FMD	Asymptomatic	Mouth lesions	Mouth lesions and Mild lameness	Mouth lesions and severe lameness	Deaths
Case I	172	156	51	22	57	22	4
Case II	62	59	8	12	16	12	11

**Graph 1.** Percent comparison of foot and mouth disease on the basis of complications

A marked painful swelling of the coronet in some members was too painful as they regularly used to stamp their feet. The characteristic thin walled ruptured vesicle of feet containing straw colored fluid, which caused discomfort within the affected individual, this leads to their lameness. Even the animals with mild lameness were preferred to sit down frequently and were unwilling to move. According to OIE Code Commission [7] the morbidity may come close to 100% but mortality in general is 1–5% in adult animals and up to 20% in lambs. However, within 4 days, case I showed 2.32% mortality rate (weighed up to 38 – 52 kilograms) while in case II mortality started from the 3rd day onwards which ended on the 15th day with 17.74% mortality rate (8 males and 3 females) (Graph 1).

According to Kitching & Hughes [20] during FMD, the lambs and young members of flock are more susceptible to death, but no case of lamb death was reported from both case studies. It was also reported morbidity rate was below 100%. Case I showed diseased members (90.69%) asymptomatic members (29.65%), mouth lesions (12.79%), mouth lesions with mild lameness (33.13%) and mouth lesions and severe lameness (12.79%) while Case II showed diseased members (95.16%), asymptomatic members (12.90%), mouth lesions (19.35%), mouth lesions and mild lameness (25.80%) and mouth lesions and severe lameness (19.35%) (Graph 1). Almost similar

results were reported by Nyaguthii, et al. [24] at Kenya and the results were different from the study of de Rueda [21].

Table 2. Pregnancy complication comparison during Foot and mouth disease Outbreak

Total number of ewes	No. of Pregnant Ewes	Abortion of ewes in Outbreak	Abortion %age during Outbreak
64	49	4	8.163265
27	18	16	88.88

Field reports present that FMD causes abortion in sheep [22]. Littlejohn [23] cited from the studies of Oppermann [23] that average abortion rate of ewes varied from 3 – 10% and sometimes it reaches up to 37% while it might be as high as 100% in some cases. Here during the study, Case I showed a low rate of abortion (8.16%) while Case II showed a higher abortion rate (88.88%) (Table 2). In Russia during 1961, 230 pregnant ewes out of 754 underwent abortion, and it was also mentioned that abortion occurred in early months of gestation [24].

4. Conclusion

As of yet, there is no specific treatment available against FMD virus, and the limitations and disadvantages in the

use of vaccines divert the focus of researchers toward natural sources like plant extracts which possess potential antiviral activity. The various research works documented in the literature demonstrated various plant extracts with antiviral potency.

The traditional knowledge of plants for the management of Foot and Mouth Disease is supported and it resulted in rapid healing of the disease. Thus the usage of these plants for curing FMD in Case I was fruitful. According to the results we as a team recommend the usage of *S. alba*, *S. babylonica*, *C. arvensis* and *B. oleraceae* var. *gangylodes* for treating FMD with the medicines as recommended by Veterinary department. These plants are cheap, locally available and easy to apply.

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Conflicts of Interest

We the authors of this work have no conflict of interest.

Author(s) Contribution

MAD, JAM and SAT designed the study plot, MAD collected the field data; MAD, JAM, SAT and SM did data analysis; MAD wrote the manuscript in consultation with JAM, SAT and SM. JAM and SAT helped with plant identification; SM helped in analysis and manuscript correction

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