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Chapter

Foot-and-Mouth Disease in India: Past, Present and Future Outlook - A Review

S.D. Audarya

Abstract

Foot-and-mouth disease (FMD) affects domestic livestock population of India causing heavy economic losses to the animal owners. Clinical form of the disease is readily noticed in susceptible livestock population mainly cattle, buffalo and pigs but saliently maintained in carrier animals. Foot-and-mouth disease control programme (FMDCP) is run in India by adopting series of measures from clinical diagnosis of the disease in the field, to sending clinical samples for laboratory diagnosis and till selection of vaccine candidates. Vaccines are used to cover all the susceptible livestock population. This is expected to minimise economic losses to the livestock owners due to the disease. The Government of India has been carrying out intensive FMDCP in a phase wise manner since 2003–2004 and subsequently by 2017–2018; it has covered all the districts of the country. The FMDCP is intending to vaccinate all the susceptible livestock population of the country such as cattle, buffalo, sheep, goats and pigs. That exercise was adopted to make the country free of the disease till 2025–2030. Directorate on FMD is functioning untiringly in this regard and International center on FMD has been set up to serve the South Asian Association for Regional Cooperation (SAARC) region. In the present chapter merits and shortfalls in the Foot-and-mouth disease prevention and control strategy will be discussed.

Keywords: foot-and-mouth disease, livestock, prevention and control, India

1. Introduction

Foot-and-mouth disease (FMD) is one of the most important viral diseases of large ruminants in India [1]. FMD affects mainly cattle, buffalo and pig population of the country producing severe symptoms. It can also infect sheep, goats and captive and free-range wildlife population [2–5]. The affected large ruminants exhibit high fever, excessive frothy salivation, vesicles in the mouth specially on the tongue, teats and inter-digital space and decrease in milk yield due to reduced feed intake. Apart from vesicular presence on the snout, lameness is a major feature in affected pigs. The disease is caused by the Foot-and-mouth disease virus (FMDV) classified in the genus *Aphthovirus* in the family *Picornaviridae*. It is a highly contagious viral disease transmitted mainly by close contact and through aerosols and respiratory

route. It produces higher morbidity percentages in susceptible population of all ages and mortality specially in young calves due to heart affections (tiger heart). The genetic material possessed by FMDV is a ribonucleic acid (RNA). During the FMDV replication, there are chances of generation of newer progeny virus particles.

Presence of FMDV infection in India, dates back to as early as 1864 and thereafter it has been reported from many parts of the country [6]. Out of the known seven FMDV serotypes (O, A, C, Asia1, SAT1, SAT2, SAT3) of FMDV found across the globe, four serotypes viz., O, A, C, and Asia 1 were reported in livestock in India, before 1995 (World Reference Laboratory, (WRL), Pirbright). Type O was reported in 1944, type A in 1959, type C in 1955 and type Asia1 in 1951.

Probably, due to the quadrivalent vaccination against FMD and for unexplained reasons, FMDV serotype C was not recorded in India from 1995 onwards. At present only three serotypes (O, A and Asia1) of FMDV are circulating in livestock population of the country [7]. Inactivated FMDV vaccines are readily available in Indian market to prevent and control FMD [8, 9]. As diagnosis and slaughter policy cannot be practiced in India (due to ethical and socio-economical reasons), routine vaccination is the best way to achieve protective antibody response against FMD in the vaccinated animals. This chapter tries to summarise India's efforts to prevent and control FMD.

2. Livestock census and contribution of livestock in the Indian economy

For a successful implementation of animal health prevention and control programme, it requires correct and authenticated data on the susceptible livestock population. In India livestock census is conducted periodically after its first beginning in the year 1919 onwards. Recently for its 20th livestock census recording of on-site livestock heads, across 270 million households and households enterprises/non-households enterprises and institutions (660 thousand villages and 89 thousand urban wards) India adopted collection of the data by using information technology and online transmission of the data through the state National Informatics Centre (NIC). The provisional statistics of the 20th livestock census have been released for the user [10, 11].

These data sets will prove very helpful for authorities of animal health departments to devise further prevention and control strategies at the event of any new outbreak. Although provisional livestock census data only highlight about the population count regardless of its health and vaccination status, it is strongly believed that at this level of counting of the livestock, the status of vaccination for individual animal also needed to be recorded at that time and data must have been released publicly. This will not only help to know about the exact health status of the livestock population in respect to vaccination but also cross-check the number of vaccinated animals claimed by authorities [12] (**Table 1**, **Figure 1**). So, technology driven livestock census and collection of correct data on livestock will help in implementation and follow up of any livestock disease control programme in India and ultimately leading to reduction in economic impacts of the disease [13].

Internationally, India ranks first in production of milk. India produced 1,76,347.35 thousand tonnes of milk, 7,655.61 thousand tonnes of meat and 41,462.72 thousand kilogrammes of wool in the year 2017–2018 [14]. The livestock sector provided and continues to provide an additional income source to many of the farming communities in India involved in the agriculture sector. It earns foreign currency by exporting livestock products.

Kind of animal	Population (million)	Change	Susceptibility to FMD
Cattle	192.49	(+)00.80%	Highly susceptible
Goat	148.88	(+)10.10%	Susceptible
Buffalo	109.85	(+)01.10%	Highly susceptible
Sheep	074.26	(+)14.10%	Susceptible
Pigs	009.06	(−)12.03%	Highly susceptible
Mithun	000.38	(+)26.66%	Susceptible
Horses and ponies	000.34	(−)45.58%	Not susceptible
Camels	000.25	(−)37.05%	Not susceptible
Donkeys	000.12	(−)61.23%	Not susceptible
Mules	000.08	(−)57.09%	Not susceptible
Yak	000.058	(−)24.67%	Susceptible

Table 1.
Susceptible livestock population to FMD in India.



Figure 1.
Cow exhibiting clinical signs of FMD. (A) Drooling of saliva; (B) Tongue lesions.

3. Literacy and its impact in the epidemiology of FMD in India

As per the population census in 2011, the literacy rate of India is 74.0% (females: 65.5% and males: 82.1%). Though gap in literacy rate is heading downwards from 21.6% in 2001 to 16.6% in 2011, there are larger variations in literacy rates in males and females among various states [15]. Illiteracy is also one of the impeding factors for personnel in livestock sector to be informed about the various activities undertaken by the central and state agencies and act upon in the event of the outbreak of the disease [16]. Though, India is implementing various educational schemes (Education to all), it is hoped that the next census will reflect improvement in literacy rates. It will help the country in respect to spreading awareness about the disease and formulation of better prevention and control strategies.

4. Foot-and-mouth disease control programme in India

Due to heavy morbidity in susceptible livestock population and negative social and economic impact of the Foot-and-mouth disease, Indian government has started progressive control pathway for FMD according to the protocols given by

Office Internationale-des-Epizooties (OIE)/Food and agriculture organisation (FAO) to minimise losses [17]. Progress for covering all the districts under the umbrella of FMDCP is presented in the **Tables 2** and **3** [18, 19].

The nine major activities that are being undertaken in the FMDCP are:

1. To vaccinate cattle and buffaloes at six monthly intervals.

2. Publicity and mass awareness campaigns.

3. Identification of target animals.

4. Sero-surveillance and monitoring of animal population on random basis.

5. Mass vaccination.

6. Procurement of cold cabinets and vaccine.

7. Quality assessment of randomly collected samples from vaccine preparations.

8. Typing of FMDV in case of outbreaks.

9. Recording/regulation of animal movement from unvaccinated areas.

In order to check whether the FMD vaccine, used in the FMDCP (at six monthly intervals), elicited protective immune response in the vaccinated large ruminants, randomly collected serum samples are being tested (**Table 2**). Paired serum samples are collected (the first serum before vaccination and the second after 21–30 days post vaccination from the same animal). These serum samples are collected from randomly selected 10 villages in each district from 10 cattle and 10 buffaloes after every vaccination. That means there are two rounds of vaccination in the year and 200 samples will be collected from each category of animals, cattle and buffaloes. So, to conclude from every district around 400 serum samples will be tested to evaluate whether the large ruminants elicited enough neutralising antibody response and protective enough to thwart future FMD outbreaks. A table indicating various institutions that are related to FMD activities is presented (**Table 3**). There are around 733 districts in India and assuming that 400 samples are generated after the end of a year (a total number of estimated serum samples screened to check for neutralising antibody response against FMDV in a year: 733 × 400 = 2,93,200). From the year 2017–2018, all the districts were covered under FMDCP, so, data for two subsequent years 2017–2018 and 2018–2019 must be made available (for a total of 5,86,400 number of serum samples) to arrive to the logical conclusions regarding

Year	Districts included	Species covered
2003–2004	54	Cattle, buffalo
2010–2011	Extended to 167 districts	
2015–2016	415	
2017–2018	All	
2019–2024	733	Cattle, buffalo, sheep, goats, pigs

Table 2.
Districts covered in FMD control programme.

Institutions	Year	Achievements and activities
Indian Veterinary Research Institute, Mukteshwar	1943	Vaccination, Virus serotyping
All India Co-ordinated Research Project, Mukteshwar	1968	For FMD virus serotyping, Central FMD laboratory at Mukteshwar and three regional centers at Hisar, Hyderabad and Kolkata
All India Co-ordinated Research Project, Mukteshwar	1971	For epidemiological studies on FMD, Facilities and manpower for extensive FMD surveillance throughout the country
Project Directorate on Foot-and-mouth disease, Mukteshwar	2001	At Mukteshwar and a network of laboratories located at various places in India, Diagnosis of FMD, Vaccine matching studies, Virus typing, Serological surveillance, Epidemiology
Directorate of Foot-and-mouth disease, Mukteshwar (http://www.pdfmd.ernet.in/)	2015	FAO reference center for FMD in South Asia, Member of a global FMD research alliance
International Center on FMD, Arugul	2017	BSL3 + Ag facility
Indian Immunologicals Limited, Hyderabad (http://www.indimmune.com/business-unit/animal-health/vaccines/livestock-vaccines), Established by National Dairy Development Board in 1982 (https://www.nddb.coop/services/rdbiotech/immunology)	1999	Vaccine manufacturing technology obtained from M/s. Wellcome foundation, United Kingdom, Has the capacity of producing 360 million trivalent doses of FMD vaccine and also exports the vaccine (Raksha Ovac, Raksha Triovac, Raksha Biovac), 80% and more vaccine for FMDCP in India
Chaudhary Charan Singh National Institute of Animal Health, Baghpat	2010	Quality control of FMD vaccine, Facilities of BSL2 and BSL3
National Institute of Veterinary Epidemiology and Disease Informatics, Bangalore (https://nivedi.res.in/about-us) formerly Project Directorate on Animal Disease Monitoring and Surveillance	2000	Epidemiology, Prediction, prevention and control of FMD threats, Weather based animal disease forecasting (National Animal Disease Referral Expert System- http://nivedi.res.in/Nadres_v2/), Use of artificial intelligence
Brilliant Biopharma Pvt. Ltd., Hyderabad (https://brilliantbiopharma.com/products/foot-and-mouth-disease-vaccine-20ml30ml100-ml/)	1988	BSL3 facility to produce animal vaccines, Supply vaccines to FAO and export vaccines (FUTVAC)
Biovet, Malur (http://biovet.in/)	2007	BSL3+ Ag production facility, Production of FMD vaccines (Bio-FMD oil), Export
Intervet India Pvt. Ltd., Pune	2004	Production of FMD vaccines, Export
Indian Agricultural Statistics Research Institute, New Delhi	2010	Center for Agricultural Bioinformatics (FMD tropism)

Table 3.
Institutes/companies that are involved in FMD research/manufacturing of FMD vaccines in India (the year represented establishment/start of functioning).

appropriate level of protective antibody response in the vaccinated animals. Early workers also commented on the weakness of the national eradication schemes in India [20]. Testing data of cattle and buffaloes from randomly selected villages as mentioned in the beginning are unavailable. Currently India is in the Stage 3 of FAO's progressive control pathway (PCP) for control of FMD [21].

The annual report of the Directorate on FMD (2017–2018) elaborated in detail on the progress of bi-annual vaccinations in different states of the country. A total of 10,02,437 serum samples were tested to assess the level of immunity. Many of the Indian states indicated development of low level of herd immunity and hence the report emphasised on regular vaccinations in the states that have low herd

immunity. It was also stated that during the year 2017–2018, 21.2% cattle and buffalo and 18% sheep and goats tested positive in differentiation between infected and vaccinated animals [21]. These results when compared to the data available for the year 1995 (positivity in DIVA: 91% in cattle and buffalo and 74% in sheep and goats) indicated significant reduction in circulation of FMDV in livestock population. Thus, successful administration of FMDCP at official and ground levels and effective implementation of its mandate resulted in reduction of FMDV circulation in susceptible livestock population.

A total amount of ₹ 3.0653 billion was released by the central Government towards implementation of the control programme [12]. However, as per the data available, a total of 381.51 million livestock population (cattle and buffaloes) received the vaccine for protection against FMD in the country. Though, the state-wise data presented, for the vaccinations were not reflecting on percentages of cattle and buffalo vaccinated till date in that respective state and also for those animals yet to receive the vaccine.

5. Vaccines and vaccination for Foot-and-mouth disease in India

In India, Directorate of FMD located at Mukteshwar in the state of Uttarakhand and its collaborating and regional centers across the country are involved in continuous survey, monitoring and collection of clinical samples for virus typing and isolation from susceptible livestock population during the disease outbreaks. After isolation of a particular type of FMDV, it is stored in the virus repository for further studies. Currently, the national FMDV repository has a total of 2,188 FMDV isolates (1,482, 325, 15 and 366 belonging to the types O, A, C and Asia1 respectively) [21]. Its tally of FMDV isolates is increasing each year. These FMDV isolates are used in genotyping studies by using latest molecular biological methods and other vaccine matching experiments.

A detail on FMD vaccines is available [22]. Vaccines are one of the very important tools in the control of FMD in India [23]. Previously, India used quadrivalent inactivated FMDV vaccines (containing FMDV antigens for types O, A, C and Asia1) to control the disease. The FMDV strains used in the production of inactivated FMDV antigens for trivalent vaccines (FUTVAC) are: for type O-IND/O/R2/75, type A-IND/A/40/2000, type Asia1-IND/Asia1/63/72. The Directorate also monitors suitability of FMD antigens employed in the production of the FMD vaccines. After critical studies the directorate also recommends to the vaccine manufacturers in the country for any requirement of inclusion of suitable FMD strain of the particular FMDV type used in the vaccine production (which can confer better protection).

There were no reports in the country for the involvement of type C FMDV in the disease outbreaks hence FMDV antigen for type C was omitted from the vaccine. The absence of type C in the country may be due to implementation of vaccination programme in FMDCP or unknown reasons. At present, only trivalent inactivated FMDV vaccines are used in immunisation programmes of the livestock population in India.

India is continuously trying to increase its capability to produce sufficient doses of FMDV vaccines required in FMDCP to cover vaccination of small and large ruminants and pigs. Though, it is a big task to vaccinate susceptible livestock population but possible because of the good veterinary services [24]. Private vaccine manufacturers such as Intervet, Biovet and Brilliant Biopharma Pvt. Ltd. are ramping up the production of doses of FMD vaccines not only to cover its domestic needs but also for the export of vaccines to demanding countries. The Central Government of

India extend financial help to the Indian states for procurement and administration of vaccines to the susceptible livestock population for prevention of FMD. Present vaccines are administered at six-monthly intervals to each animal to generate sufficient level of protective immunity. Some researchers suggest that increase in the antigenic mass of the vaccine may elicit higher level of protective antibodies in the vaccinated animals (which gives protection for longer duration). Though, it seems difficult as it will increase the cost of FMD vaccines.

During FMD outbreaks, there can be economic loss of up to 80.68% attributed to reduced milk yield. Hence, to contain economic losses due to FMD, vaccination to susceptible livestock population is must. India hosts 43 indigenous cattle breeds and 13 buffalo breeds (milch and draft purpose breeds). Apart from these well documented cattle and buffalo breeds, it also holds non-descript and crossbred cattle population. Large ruminants in India are reared mainly for milk production and also for the field work in the farmland. India ranks first in the production of milk (176.3 million tonnes in 2017–2018). Milk production in India from 1950 to 1951 onwards is presented (**Figure 2**). In the country work on FMD vaccination was started from the year 1943 onwards and many vaccine manufacturers are venturing into large scale production of doses of FMDV vaccines (**Table 3**). In FMDCP, all the susceptible livestock population is being covered for conferring protection against FMD through vaccinations and thereby mitigate economic losses including that from reduced milk yield. Hence, vaccination programmes in FMDCP indirectly helped India to achieve first rank in milk production in the world.

FMD outbreaks were reported even in vaccinated animals. It leads to doubt the quality of the vaccines and vaccinations [25, 26]. It creates unnecessary fears in the livestock owners. Though, timely vaccinations reduce the incidence of the disease outbreaks and thereby reduction in antibiotic requirements for the treatment of animals for those conditions that may arise due to involvement of secondary bacterial infections during the disease outbreaks. Eventually, vaccinations help to reduce antibiotic residue in the food animals and its products [27].

Availability of rapid diagnostic testing kits for FMD allows early detection of FMD which in turn will help in devising preventative and control strategies. Early detection will help in immediate segregation of diseased animals from healthy to minimise the spread of the infection. It also alarms Government bodies to vaccinate nearby animals in the periphery from the index case (ring vaccinations) to curtail further spread [28, 29].

Critics are pointing on the fact that though vaccination is practiced in the country for prevention and control of FMD, yet, there is more than 20% of reactivity to FMD non-structural protein (NSP) 3AB3 indicative of FMDV exposure in field animals. They opined that vaccination has not resulted into generation of

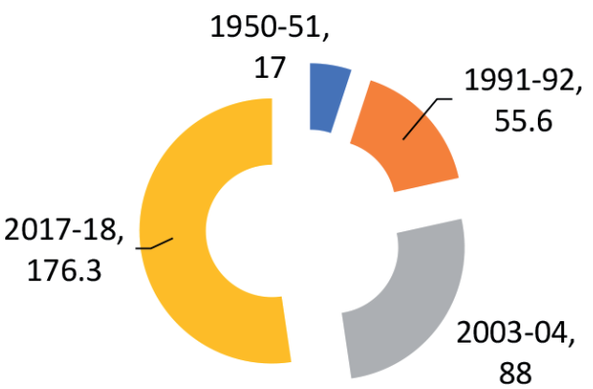


Figure 2.
Milk production in India (in million tonnes).

sufficient levels of protective immunity in the animals and poor vaccine quality. To check FMDV vaccine quality, Government of India has set up a vaccine quality testing facility at Baghpat (**Table 3**). FMDV has RNA as a genomic material. During the process of viral replication, there are chances of mutations in the FMDV genome and sometimes it may be possible that the antibodies generated after the vaccination may not be able to neutralise the circulating strain of the FMDV. Apart from this, there are many factors like persistent FMDV infections, nutritional status of the host, parasitic infestation of the host and other miscellaneous complexities prevalent in field conditions of such a vast country which can have its impact on the vaccination programme [30]. Still, FMDCP in India achieved a success in terms of reduction in FMD outbreaks as discussed below.

6. Reduction in Foot-and-mouth disease outbreaks reported in India

Foot-and-mouth disease control programme (FMDCP) is led by Department of Animal Husbandry Dairying and Fisheries, Government of India. Due to continuous efforts to prevent and control the FMDV infection in susceptible livestock population especially large ruminants, there is significant reduction in number of FMD outbreaks reported during the years 2012–2018 to that of the FMD outbreaks reported during the years 2002–2012 (**Figure 3**). Reduction in the number of outbreaks reported is largely due to comprehensive sero-monitoring, epidemiological investigations, increased diagnostic capabilities, trained manpower, competency in vaccine manufacturing capacity to cover the livestock population in the vaccination programme and Government push.

In 2019, fully central Government backed National Animal Disease Control Programme (NADCP) of ₹ 126.52 billion was launched to vaccinate 600 million animals to control FMD and Brucellosis. It is hoped that with this continuous efforts and interest of the authorities and guidelines formulated, there will be implementation of the FMDCP more effectively and efficiently [31, 32] resulting into further reduction in the incidence of the disease and ultimately eradication.

However, there must be positive criticism in few regards. As the data stated that there is no incidence of FMD in Madhya Pradesh during the year 2017–2018 but the adjoining states to Madhya Pradesh, Rajasthan, Gujarat and Uttar Pradesh reporting

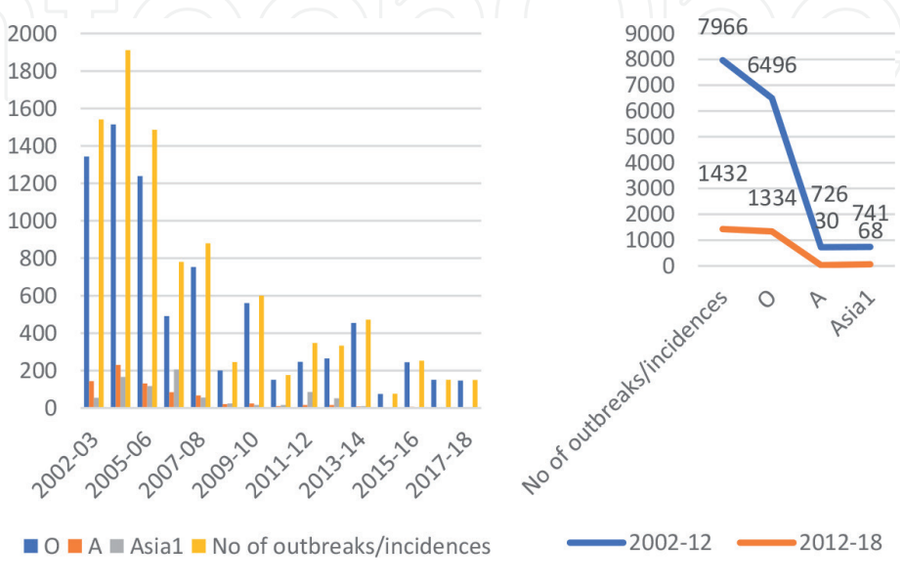


Figure 3.
FMD outbreaks/incidences in India.

the disease? Migratory small ruminants and camels are used to reach Madhya Pradesh from Rajasthan. Cattle are being procured from Gujarat, yet astonishingly the state is not reporting any incidence of FMD for the last few years. Ironically, it reported about 18% reactivity to non-structural proteins (NSP) and as a corollary more is the presence of anti-NSP antibodies, more will be the incidence of FMD. That's not holding true in this case. It can be concluded that the FMD incidence is underreported in this case. The author is a witness to a farm visit, where the cattle owner was not aware even about the vaccination practices in his last 30 years of livestock rearing. Similarly, in one of the other studies FMD was reported at Bulandshahr in Uttar Pradesh where mortalities had happened even in vaccinated animals but at a lower level than the unvaccinated ones in the year 2015 [33].

As there will be reduction in the number of outbreaks reported in a state various known and unknown pressures would play a role in hiding any further positive cases of FMD. Few random visits of authorities from a different state can be planned during vaccinations and further monitoring. Hence availability of a dedicated contact number as envisioned in NADCP for reporting the outbreak by common man or livestock owner will bring more transparency. Since each one of the eligible cattle, buffalo, sheep, goats and pigs will receive vaccine for protection against FMD, the processes of vaccinations, blood collections and follow up needed to be fully recorded digitally. The internet data is cheapest in India, presently. So, location tracing applications can be developed and used to monitor actions of vaccinators and other workers. In India, declaration of monetary incentives for reporting about the incidence of the disease will not only bring more transparency in reporting the disease but also serve a great cause to prevent and control it.

If an outbreak of FMD is noticed at a place, it needed to be reported immediately as per the FMDCP. But at the field level due to unawareness of significance of reporting an outbreak and unexplained pressures experienced by the workers, sometimes, at some places, it may go unreported. Hence it is desirable to spread awareness among common man and livestock owners regarding the programme. This programme is yet to popularize, countrywide, in livestock owners in respect to the basic understanding of the disease and its prevention and control. As there are still few pockets of the farmers left who are not willing to vaccinate their animals [33]. Such farmers needed to be identified and must be penalised else all the good of the control programme would be in danger. More coverage by the print and press media is needed to spread mass awareness. Once you start any programme subsequently it will be closely watched by the benefactor and also common public for the progressive outcome. Moreover, recently FMD outbreaks even in the vaccinated animals population raise unwarranted doubts in the animal owners unless they are better addressed about the epidemiology and transmission of the disease in a better way. Earlier states may also be reluctant to disclose the incidence of the disease due to further compliance to the provisions of the Prevention and Control of Infectious and Contagious Diseases in Animals Act, 2009. Awareness about the disease in a household is very important. A household's health-seeking behaviour influences selection into preventative care interventions [34].

7. Discussion

India is having a huge experience in recording of the data of its citizens and generating identity cards. Sometimes these cards are essential to have access to and avail certain facilities by its citizens. National level coding of individual designated livestock (if not for all) where efforts to create disease free zones are on can be implemented. Migratory flocks of small ruminants and of other animals

needed to be identified and given a free pass to trace their journey. Mithun and Yaks are also susceptible for FMD but they have been kept aside from the control programme. Services of State veterinary colleges needed to be utilised in a better way and funded to for the set up of extension camps and activities which spread awareness among livestock owners. However, enthusiasm shown by veterinarians to spread awareness in the livestock owners about free FMDV vaccinations from remote locations of India in Reasi, Jammu is widely appreciated (the veterinary official took para-gliding to spread FMD awareness in the mountainous region!). There are very few reports available on impact of the FMDCP in the control of FMD [35]. Haryana state is also going to undertake trials of combined vaccines of FMD and Haemorrhagic septicaemia (HS). These combined vaccines are shown to elicit better immunity. Then the question to NADCP will be why they have chosen only Haryana for testing combined vaccines and not chosen entire country? It will be wise to go with combined vaccines for FMD and HS in the NADCP, since it will reduce the cost of vaccination and handling of the animals, save manpower, brings in additional expert manpower involved in HS research and increase its outreach. International community is closely watching the scenario as there was a report indicating transboundry movement of FMD to Sri Lanka from India [36]. So, FMD vaccines needed to be of superior quality which can confer higher level of protection by eliciting neutralising antibodies. The inactivated FMDV vaccines used in FMDCP in India, require cold chain maintenance from its production to administration in the animals. Sometimes vaccine failures can be due to improper storage of the vaccines. Presently, there is no way to confirm whether the cold chain is maintained during transportation of the vaccines or not. Vaccines can be incorporated with certain indicators whose colour may change irreversibly when exposed to higher temperatures. Secrecy is being maintained to disclose vaccine quality testing data and only few authorities are designated for the testing. Rather processes of vaccine quality testing needed to be digitally recorded and must have real time access to any viewers for positive criticism. To clear any doubts in the minds of the public due to recent controversies in vaccine manufacturing and quality control, apart from the designated national agencies for quality testing of the FMD vaccines, services of any third party national agency and if need be, international agency must be hired wherever applicable. There needed to be more coordination among institutions to share real time data for the public. Such reporting and real time sharing of the data needed to be encouraged and talked upon to relish any success stories to inspire for and to learn any lessons otherwise. Newer and newer vistas must be explored [37]. However practices based on indigenous knowledge for control and treatment of FMD from rural India is well documented [38].

8. Conclusions

India is having a will to prevent and control Foot-and-mouth disease, an economically important viral disease of livestock which causes huge annual losses of about ₹ 200 billion. In the past, India has successfully eradicated Rinderpest and Poliovirus, during those times to till now, it has tremendously enriched its know-how and institutional capabilities to handle a massive scale programme as that of FMDCP. There is a huge drop down in the number of FMD incidences/outbreaks reported as a result of this programme. India has a mechanism and expertise in place to prevent and control FMD and eradicate it by 2025–2030, but that has to be backed by the livestock owners, scientific communities, institutions and its people, enlightened for the disease by the disease, FMD.

Acknowledgements

No funds are made available or received. Author wishes to extend thanks to Mr. Abhay Pratap, UG student (B.V.Sc. & A.H.) for his help.

Conflict of interest

The author declares no conflict of interest.

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