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First Questionnaire-based Survey on the Uptake and Use of FMD-HS Combined Oil Adjuvant Vaccine in India

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ABSTRACT

Background: The Government of India allowed the State of Haryana to go for the 27th round of FMD and HS combined oil adjuvant vaccine for mass vaccination of eligible bovine population, at a six monthly interval under FMD-CP. This was the second phase of the combined vaccination. Haryana is the only state in India where a single FMD and HS combined vaccine was used in bovines as a pilot project for protection against two most economically important diseases *i.e. Hemorrhagic Septicemia* (HS) and Foot and Mouth (FMD) diseases. The aim of this study is to describe the current uptake and usage of FMD and HS dual vaccine on the basis of a questionnaire-based survey of livestock owners in Haryana.

Methods: Randomly selected livestock owners from 6 district namely Karnal, Panipat, Kurukshetra, Ambala, Panchkula and Yamunanagar of Haryana State were contacted and a questionnaire, made available in paper format, was distributed to them to participate in this study. Appropriate, answers to open questions were categorised into themes using thematic analysis methodology (Attride-Stirling, 2001).

Result: Total of 96.81 (ninety six point eight one) percent of respondents (n=942/973) had their cattle vaccinated. Of the 31 respondents who excluded their animals from the vaccination, 58.06 percent pregnant (18/31), 16.12 percent lactating (5/31), 12.9 percent calves (4/31) and 6.45 percent sick (2/31) animals were indicated. The respondents who excluded their animals further expressed their desire to get their animals vaccinated during later stages of life.

Key words: Dual, FMD, HS, Questionnaire, Vaccination.

INTRODUCTION

Since the 16th century vaccines have been used in veterinary sciences (Mcvey and Shi, 2010) to control and eradicate disease for livestock health and welfare, as demonstrated by the global eradication of rinderpest (Normile, 2008). Vaccination is considered to be the best strategy for disease control and for minimising economic losses due to diseases, but diffusion and adoption of vaccination technology at field level is very low (Rathod *et al.,* 2016).

Foot-and-Mouth disease (FMD) and *Haemorrhagic Septicaemia* (HS) are two diseases transmitted through contact of the susceptible animal with the infected ones, causing heavy economic losses to the livestock industry. These are endemic in many countries of the world including India. FMD is a viral disease causing direct losses in the form of productivity and indirect losses in the form of restriction on international trade of livestock and their products including germplasm (Sunder *et al*., 2015). HS is an acute septicaemic disease and sporadic outbreaks occur every year in the state affecting mainly buffalo and to lesser extent cattle (Cuevas *et al.,* 2020).

Recently, Government of India has allowed the State of Haryana to go for the 27th round of FMD and HS Combined Oil Adjuvant Vaccine for mass vaccination of eligible bovine population, at a six-monthly interval under FMD-CP. This was the second phase of the combined vaccination. Haryana is the only state in India where a single FMD-HS vaccine was used in bovines as a pilot project for protection against two most economically important diseases *i.e*., HS and FMD. The FMD-HS vaccine would increase the number of animals vaccinated against FMD and HS (Chabra *et al.,* 2004).

Therefore, this study was planned to analyse the uptake and usage of dual vaccine amongst the livestock owners for the first time ever. This study at field level will provide us with valuable feedback and statistical information from livestock owners for further future studies and references.

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MATERIALS AND METHODS

Questionnaire

A paper version of the questionnaire was developed extensively covering information regarding respondents and

questions relating to use of dual vaccination in their animals. The questionnaire contained a total of 15 questions, out of which 07 questions were related to the respondents and 08 questions were related to the dual vaccine and their effects on animals. A survey was conducted amongst farmers between November, 2019 to January, 2020. It took approximately 07 minutes to complete the survey. Pretesting of the questionnaire was carried out with four veterinarians, eight veterinary students. Minor corrections were made and paper copies for piloting were sent to 40 farmers. The questionnaire received from pilot participants, was finalised for distribution among the respondents. The data was collected on paper copies *via* direct contact at farm level and telephone lines. Other necessary information was also gained through secondary sources such as departmental records, reports *etc.*

Distribution

The target population was randomly selected livestock farmers from the 6 Districts of Haryana State namely Karnal, Panipat, Kurukshetra, Ambala, Panchkula and Yamunanagar, who owned or worked with cattle. The survey was conducted during the period of November, 2019 to January, 2020 in which farmers were selected through random sampling. The purpose of the survey was explained to the farmers prior to the distribution or filling of the questionnaire. Livestock owners were contacted either directly at their farm or house level or through telephone, *via* contact establishment from respective districts. Responses collected from farmers were physically filled in paper copies of survey questionnaires.

Statistical analysis

A datasheet was created using Microsoft Excel (2010) and questionnaire responses were manually entered. Ten per cent of the questionnaires were checked to detect data entry errors; no errors were observed. Where appropriate, answers to open questions were categorised into themes using thematic analysis methodology (Attride-Stirling, 2001). The questions, for which it was possible to select more than one answer; in those cases, the cumulative proportions could exceed 100 per cent. The data collected from sample respondents were coded, analysed and presented in the form of tables. The data were analysed using the chi square test.

RESULTS AND DISCUSSION

Respondent demographics

The questionnaire was completed by 973 respondents between November, 2019 and January, 2020 (Table 1). Respondents were contacted in the study period when the vaccination process was just completed. The response rate for the paper based questionnaire was estimated at

Table 1: Information about the respondents of the questionnaire. Number (%)

Factor	Level	Cattle (N=426)	Buffalo (N=547)	Total (N=973)
Overall		426 (43.78)	547 (56.22)	973 (100)
Gender	Male	359 (84.27)	448 (81.9)	807 (82.94)
	Female	67 (15.73)	99 (18.1)	166 (17.06)
Age (years)	< 20	107 (25.12)	98 (17.92)	205 (21.07)
	20 - 50	138 (32.39)	183 (33.46)	321 (32.99)
	≥ 50	181 (42.49)	266 (48.63)	447 (45.94)
Educational qualification	Illiterate	35 (8.22)	52 (9.51)	87 (8.94)
	Primary	115 (27)	137 (25.05)	252 (25.9)
	Middle	106 (24.88)	127 (23.22)	233 (23.95)
	High school	77 (18.08)	108 (19.74)	185 (19.01)
	Secondary	51 (11.97)	76 (13.89)	127 (13.05)
	Graduate and above	42 (9.86)	47 (8.59)	89 (9.15)
Size of landholding (acres)	Landless	77 (18.08)	137 (25.05)	214 (21.99)
	Small (up to 5)	269 (63.15)	314 (57.4)	583 (59.92)
	Medium (5-10)	55 (12.91)	62 (11.33)	117 (12.02)
	Large (≥10)	25 (5.87)	34 (6.22)	59 (6.06)
Caste	SC/ST	60 (14.08)	86 (15.72)	146 (15.01)
	OBC	115 (27)	137 (25.05)	252 (25.9)
	General	251 (58.92)	324 (59.23)	575 (59.1)
Dairy farming experience (years)	<05	81 (19.01)	75 (13.71)	156 (16.03)
	05 - 20	187 (43.9)	241 (44.06)	428 (43.99)
	≥ 20	158 (37.09)	231 (42.23)	389 (39.98)
Herd size (animals)	Small (1-5)	294 (69.01)	426 (77.88)	720 (74)
	Medium (5-10)	77 (18.08)	79 (14.44)	156 (16.03)
	Large (10-20)	38 (8.92)	30 (5.48)	68 (6.99)
	Dairy farm (>20)	17 (3.99)	12 (2.19)	29 (2.98)

97.3 per cent (n=973/1000). Non respondents were not further investigated.

Vaccine uptake

Specific questions were asked about uptake of the vaccine and 96.81 per cent (n=942/973) of respondents indicated that they got their animals vaccinated (Table 2). 3.19 per cent (n=31/973) of respondents excluded certain animals from vaccination (Table 2). When prompted for further information, animals which were most frequently excluded from vaccination were pregnant (58.06%, 18/31) and lactating (16.12%, 5/31) animals, with no significant differences observed in relation to vaccination status of cattle and buffalo (Table 3). In a similar study Rathod *et al.* (2016), also found that nearly 86.4% of respondents believed that livestock vaccination was relevant to local production practices. Scott and Gunn, (2008) also stated that improved immunity through vaccination can reduce the risk of losses at farm.

Vaccine usage

Specific questions were asked to the respondents regarding the vaccine usage they were familiar with. Respondents indicated multiple motivations for getting their animals vaccinated including disease control (88.85%, n=837/942), losses (87.79%, n=827/942) in terms of money and production, veterinary advice (79.62%, n=750/942), Disease testing/monitoring (23.78%, n=224/942) and requirement for sales (26.86%, n=253/942) (Table 4). Datasheets of Dual Vaccine recommended that unhealthy animals should be excluded from vaccination, as vaccinating immune-compromised animals may lead to ineffective protection. In this survey, farmers excluded sick (n=2), pregnant (n=18) and lactating (n=5) (Table 3). Respondents stated they excluded pregnant animals from being vaccinated for fear of abortion. However, the number of excluded pregnant animals was far lower. This may be due to farmers being unaware or not being advised of the risks of vaccinating pregnant animals. Other reasons for not excluding animals could be that a whole herd approach is being taken for management purposes and all animals are being vaccinated, rather than selecting animals individually for adequate disease control. In a similar study Cresswell *et al.* (2014) reported that in their survey nearly 33 per cent of respondents excluded certain animals from vaccination, out of which 6 per cent excluded pregnant animals from vaccination.

While the most frequent reason/motivation for not getting their animals vaccinated was that they did not perceive there to be a problem that required vaccination (n=18/31, 58.06%) (Table 2). Cresswell *et al.* (2014) also found in their survey that farmers who did not vaccinate their animals did not perceive there to be any problem. Economic factors as more than half the respondents had discussed decrease in production and stress associated with vaccination after administering the dose. Rathod *et al.* (2016) also found in their survey that there was a significant difference ($p<0.001$) among the farmers of different states

Table 2: Information about animals vaccinated and their post vaccination management Number (%).

Particulars	Cattle (N=426)	Buffalo (N=547)	Total (N=973)	Chi-square test
Whether the animals were vaccinated or not?				
Yes	417 (97.89)	525 (95.98)	942 (96.81)	2.83^{NS}
No	9 (2.11)	22 (4.02)	31 (3.19)	
Source of information/knowledge transfer regarding post vaccination management in animals?				
Newspaper	94 (22.07)	130 (23.77)	224 (23.02)	0.95^{NS}
Internet	68 (15.96)	107 (19.56)	175 (17.99)	3.06^{NS}
Veterinary Hospital	375 (88.03)	461 (84.28)	836 (85.92)	0.01^{NS}
Other	81 (19.01)	75 (13.71)	156 (16.03)	3.84*

*Significant at 5% level; NS: Non-significant.

Table 3: Information about animals not vaccinated number (%).

Particulars	Cattle (N=9)	Buffalo (N=22)	Total (N=31)	Chi-square test
Which animals were excluded from vaccination?				
Sick animals	1 (11.11)	1 (4.55)	2 (6.45)	2.31^{NS}
Pregnant animals	5 (55.56)	13 (59.09)	18 (58.06)	
Lactating animals	1 (11.11)	4 (18.18)	5 (16.12)	
Calves	2 (22.22)	2 (9.09)	4 (12.9)	
Others	0 (0)	2 (9.09)	2 (6.45)	
What was the motivation for not getting your animals vaccinated?				
Did not perceive there to be a problem	8 (88.89)	9 (40.91)	18 (58.06)	5.94*
Lose in production during previous vaccination	7 (77.78)	6 (27.27)	12 (38.71)	6.69**
Have never used to	4 (44.44)	6 (27.27)	8 (25.81)	0.86^{NS}

*Significant at 5% level; **Significant at 1% level; NS: Non-significant.

of the country as compared to Haryana and Punjab states which might be related to the socio-economic condition of farmers. Whereas, Lal, (2000), in his study found that the majority of farmers were not familiar with the vaccination process and not aware that vaccinations were being carried out for certain diseases. Habiyaremye *et al.* (2017), in their survey observed that the majority of famers (86%) believed in the importance of vaccination. As per Rathod *et al.* (2016), the adoption of vaccination is poor at field level. Rathod *et al.* (2013) mentioned that the states should also undertake extensive livestock extension activities to educate farmers about the benefits of vaccination. In a study conducted by Hesterberg *et al.* (2007), reported that 84.8% of smallholder livestock farmers vaccinated their cattle.

Majority of farmers (n=839/942, 89.07%) vaccinated their animal through the intramuscular route which is the most preferred route of vaccine administration. However, 3.18% (n=30/942) of farmers vaccinated their animals *via* subcutaneous route and merely 0.32% (n=2/942) of farmers informed about intravenous administration and 7.54% of farmers had no information regarding the route of administration (Table 4). Most farmers vaccinate their animals *via* intramuscular route as the majority of vaccination is done under guidelines and supervision of field veterinarians and staff, which explains the correct administration route of vaccine. Whereas, some farmers might not have access to the veterinary services, they may have contacted some untrained practitioner or supplier, who would have injected the vaccine *via* the least preferred route. In a study on other veterinary medicines, such as ivermectin and ceftiofur sodium depicted no difference in the efficacy of the drug, regardless of the route of administration, using intramuscular versus subcutaneous (Lifschitz *et al.,* 1999).

Vaccination drive was mostly carried out by veterinarians (n=438/942, 46.5%), VLDAs (n=311/942, 33.01%) and staff workers (18.58%) of the GVH/GVD. Only 4.56 per cent (n=43/942) of respondents indicated that they or somebody else vaccinated their animals. Generally, no specific qualifications are required to be a Para-veterinary or Gopal worker; it may be that some of them carried out vaccination with no formal training. Further work to confirm the effect of training for vaccine efficacy may help to focus future activities. Habiyaremye *et al.* (2017) also found that 85% of the farmers prefer a vaccine that can be used to treat multiple diseases.

In the study, veterinarians are valued by respondents as important discussion partners (88.03%) regarding post vaccination management in animals, who shared with them their expertise in addition to supplying vaccines (Table 4). It highlights the potential opportunity for the veterinarian to combine their role as administrator with their role as advisor about vaccination. In a study conducted by

Table 4: Farmers' responses (%) regarding FMD-HS dual vaccination number (%).

Particulars	Cattle (N=417)	Buffalo (N=525)	Total (N=942)	Chi-square test
What was the motivation for getting your animals vaccinated?				
Losses	333 (79.86)	494 (94.10)	827 (87.79)	43.96**
Veterinary advice	323 (77.46)	427 (81.33)	750 (79.62)	2.15^{NS}
To control disease	375 (89.93)	462 (88.00)	837 (88.85)	0.87^{NS}
Disease testing/monitoring	93 (22.30)	131 (24.95)	224 (23.78)	0.90^{NS}
Requirement for sales	124 (29.74)	129 (24.57)	253 (26.86)	3.16^{NS}
Have always used to	366 (87.77)	508 (96.76)	874 (92.78)	28.06**
What was the route of administration used?				
I/V	2 (0.48)	0 (0)	2 (0.21)	8.28**
I/M	358 (85.85)	481 (91.62)	839 (89.07)	
S/C	16 (3.84)	14 (2.67)	30 (3.18)	
Did not know	30 (9.83)	12 (5.71)	42 (7.54)	
Who administered the vaccine?				
Veterinarian	178 (42.69)	260 (49.52)	438 (46.5)	2.93^{NS}
VLDA	144 (34.53)	167 (31.81)	311 (33.01)	
Other staff	72 (17.27)	103 (19.62)	175 (18.58)	
Others	29 (6.95)	20 (3.81)	49 (5.2)	
Immediate post vaccination effects observed by animal owner?				
Hyperthermia	85 (20.38)	91 (17.33)	176 (18.68)	1.42^{NS}
Stress	264 (63.31)	242 (46.1)	506 (53.72)	27.70**
Anorexia/Inappetance swelling/Pain	140 (33.57)	132 (25.14)	272 (28.87)	8.04**
Abortion (If any)	0 (0)	1 (0.19)	1 (0.11)	0.65^{NS}
Decrease in productivity	307 (73.62)	335 (63.81)	642 (68.15)	10.31**
Lameness	26 (6.24)	13 (2.48)	39 (4.14)	8.27**
Others	8 (1.92)	2 (0.38)	10 (1.06)	5.23*

*Significant at 5% level; **Significant at 1% level; NS: Non-significant.

Habiyaremye *et al.* (2017) it was revealed that most respondents (94 per cent) sourced information regarding vaccinating cattle from their veterinarian, with the majority of respondents preferring face-to-face communication. Hall and Wapenaar (2012) have also found veterinarians to be most valued by farmers as important discussion partners in the field of animal health.

Nearly 68.15 per cent (n=642/942) of respondents indicated decrease in productivity on vaccine administration. Stress, Hyperthermia, Anorexia/Inappetance/Swelling/Pain and Lameness was indicated by 53.72 per cent (n=506/942), 18.68 per cent (n=176/942), 28.87 per cent (272/942) and 4.14 per cent (39/942) respondents, respectively. Stress, anorexia/inappetance/swelling/pain, decrease in productivity and Lameness was indicated significantly higher in cattle (63.31, 33.57, 73.62 and 6.24%) as compared to buffaloes (46.10, 25.14, 63.81 and 2.48%) which were significantly higher in cattle as compares to buffaloes, which may be due to species difference (Table 4). These results may attribute towards the low acceptance of vaccine among farmers citing the above constraints which may be addressed by extensive awareness programmes and other extension approaches. Rathod *et al.* (2016) also referred to such constraints linked to vaccination of animals.

Knowledge transfer

Most respondents (n=836, 85.92%) sourced information regarding vaccinating cattle from the veterinary hospital of their area. Whereas, 23.02% (n=224) and 17.99% (n=175) of respondents preferred to receive information about vaccination from a newspaper and internet, respectively. Face to face communication was preferred over other virtual means (Table 2). For the successful implementation of the vaccine programme in the state the existing veterinary services must be intensified by strengthening/upgrading institutions to achieve preventive veterinary care through door step services. Rathod *et al.* (2013) emphasised on applying hotline approach from field hospitals to the state epidemiologist and necessary inputs should be made available (Table 2).

Constraints of the study

In this study, the proportion of farmers not getting their animals vaccinated was likely to be underestimated. Bias due to convenience sampling is probable; it is likely that farmers who got their animals vaccinated and were interested in vaccination were more inclined to participate in the survey than those who did not have any interest in vaccination. Another limitation of the study was that information provided by respondents may have differed from reality, particularly when answered from memory or recall basis. Therefore, incorrect answers may have been provided by respondents.

The sample size of 973 respondents limited the power of this study; increasing the number and area of study to consolidate our findings would further support the study results. However, the area and population in the state of Haryana is known to be challenging to engage in survey based research and increasing sample size/area will take considerable effort.

CONCLUSION

As the current published body of work in the field of uptake and usage of cattle vaccines is scarce, the findings of this study are important to describe current usage strategies on vaccination. In conclusion, uptake of dual vaccines in India was generally good. It may also be concluded that the veterinarian is the main administrator and main source of knowledge for farmers in the dual vaccination programme and, therefore, remains crucial to its success. In general, the use of dual FMD-HS vaccine in place of single vaccines is better in order to immunize large number of dairy animals at a faster rate, as earlier, animals had to be vaccinated four times in a year, which was not only tedious for veterinary workers and farmers, but was also extremely stressful to the animals.

Conflict of interest

All authors declare that they have no conflict of interest.

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