

Introduction

Bangladesh is an agricultural country. In this country livestock constitutes an integral part of its agricultural sector. In addition to draft power and leather, it provides manure, meat and milk to vast majority of people. Livestock population in Bangladesh is currently estimated to comprise 25.7 million cattle, 0.83 million buffaloes, 14.8 million goats, 1.9 million sheep, 118.7 million chicken and 34.1 million ducks. The density of livestock population per acre of cultivable land is 7.37 (DLS, 2012-13).

Statistics show that about 2.9% of national GDP is covered by the livestock sector, and its annual rate of growth is 5.5%. About 20% of the population of Bangladesh earns their livelihood through work associated with raising cattle and poultry. In Bangladesh, 83.9 percent of total households' own livestock (animals or poultry or both). About 45.9 percent households possess bovines, and 76.3 percent possess poultry. On average, each household owns 1.52 bovine animals, 0.9 goat and sheep and 6.8 chicken and ducks (DLS, 2012-13). Livestock resources also play an important role in the sustenance of landless people.

Development of livestock resources depends on factors such as veterinary health services, veterinary support services, delivery systems of veterinary biological products, quality production inputs, veterinary extension services, and cooperation between private and public sectors dealing with various health problems of livestock, via diagnosis of diseases, their treatment, prevention, and control.

Vaccination is without doubt the most useful measure to prevent animal from infectious diseases. Preventing disease protects the health and welfare of animals and helps to prevent the spread of disease to humans (van Oirschot et al., 1999). Vaccines coupled with diagnostic tests, eradication programme and surveillance help to eradicate diseases (e.g. FMD, Rabies, Aujeszky's disease). They also help to reduce the annual loss of production. Routine vaccination is used by most countries in world to control about 15-20 human infectious diseases, and roughly 15 diseases are selectively targeted that are zoonotic (Knight-Jones et al., 2014). It is estimated that veterinary vaccines are available for over 400 diseases affecting mammals and birds including farm animals , pets and wildlife (Pastoret & Jones, 2004) . When discussing the control of infections in animals

it is necessary to consider different situations, including true eradication (i.e.: small pox), regional elimination or more often merely control. Two methods are used to eliminate an animal viral infection, either vaccination or the strict application of hygienic measures including “stamping out” and incineration or an integration of both methods. Public opinion is increasingly concerned about stamping out, even when necessary, such as when dealing with emerging zoonosis. Hence vaccines are considered amongst the most effective means of preventing diseases in animals.

In developing countries like Bangladesh it is hypothesized that lack of knowledge about vaccination is the major problem in livestock and pet animal vaccination. Besides that, some other factors may also impart preventing animal vaccination in Bangladesh. In India, a study was conducted on the constrains of animal vaccination. The study revealed that there were some myths in adoption of vaccination like; vaccination reduces milk production; vaccination causes infertility in animals, swelling at the site of vaccination, vaccination causes fever in animals and so on. Recurrence of disease even after vaccination, non-availability of veterinarians or skilled staff, poor infrastructure to store vaccine, non-availability of vaccine throughout the year are also some problems in adoption of vaccination by the farmers (Rathod et al., 2016). As our neighbor country has these problems in vaccination, we also hypothesized that Bangladesh may also have the similar type of problems or myths in adoption of vaccination by the farmers.

In Bangladesh vaccines are mainly supplied to the farmers from the Upazila livestock office. They supply different vaccines of various diseases throughout the year. Even after financial investments and vaccination programs, we hypothesized that the adoption rate for vaccination is poor in Bangladesh due to lack of extension programme and poor linkage with farmers.

Vaccination is the best strategy for disease control and for minimizing economic losses due to diseases, however, we have minimal published data regarding status of animal vaccination and factors that are related to unsuccessful vaccination in livestock and animals in Bangladesh. Accordingly, the objective of this study was to find out the rate of animal vaccination and factors that are related to failure of successful vaccination in field levels in rural areas of Bangladesh.

Materials and methods

A survey was conducted to identify probable risk factors associated with failure of livestock vaccination in rural areas of Bangladesh. The details of the methodology of this study as below.

2.1. Study area

The study was carried out at Sherpur district in Bangladesh.



Figure 1: Study area (Left figure indicates Sherpur district in Bangladesh map & right figure indicates only area of Sherpur district with different Upazilas).

2.2. Reference population

Farmers who rear livestock and animal at Sherpur district in Bangladesh.

2.3. Source of population

Several villages, union and the farmers of different upazilas at Sherpur district and the farmer who comes to upazila veterinary hospital for treatment or vaccination purpose.

2.4. Study population

Total 110 farmers were included in this study.

2.5. Duration of study

The study was conducted from 1 February 2021 to 30 April 2021.

2.6. Data collection

A structured questionnaire was developed and administered to identify the farmer's and their livestock details, and some other information (Appendix 1).

Farmers and details of animals were included as the source of the animal, name of the owner, educational status, and number of animal reared, species, breed of the animal etc. were also recorded. In this study we considered owners in different sections on the basis of educational background.

There were both open and close ended questionnaire in this study. All the data was collected by direct questionnaire through interviewing method. The format of the questionnaire has been added in the appendix of this report.

2.7. Statistical analysis

Data were initially stored in Excel file from the questionnaire and later descriptive statistics were calculated.

Results

3.1. Correlation between education and vaccination

Here within the total respondent, overall knowledge about vaccination was 74.54%. Among them, the proportionate prevalence (PP) of undergraduate of higher educated people was the highest (100%). The PP of college or diploma studied people was also high (95.65%). Besides that, the PP of educated people up to primary was (70.59%) and high school was (78.57%). The PP of people who don't want to disclose was (30.77%) and the people having no education had the lowest PP (30.77%) of knowledge about vaccination (Table 1).

Table 1: Correlation between education and vaccination (N=110)

Educational background	Total responded	Know importance of vaccination	Percentage
Undergraduate/Higher	10	10	100%
College/Diploma	23	22	95.65%
Primary	17	12	70.59%
High school	28	22	78.57%
Do not want to disclose	19	12	63.16%
No education	13	4	30.77%
Total	110	82	74.54%

3.2. Factors related with species and vaccination

The PP of poultry rearers (100%) was highest in terms of knowledge about vaccination. And the proportionate prevalence (PP) of the cattle owner was higher (78.26%) than the goat, dog and cat owners. The PP of goat owners was (42.11%) and the PP of dog and cat owners was both (50%).

Table 2: Factors related with species (N=110) and vaccination

Species	No. of data collected	Know importance of vaccination	Got vaccinated (percentages)
Cattle	23	18	78.26%
Goat	38	16	42.11%
Dog	2	1	50%
Cat	4	2	50%
Poultry	43	43	100%

3.3. Economic condition of farmer

The total respondent of the study is classified into three categories based on their economic condition. Among them, the proportionate prevalence is higher of those (95.45%) who having very good economic background. And the people whose economic background was good had the PP of (85.93%). On the other hand, economically poor people were less likely familiar with vaccination (16.66%).

Table 3: Economic condition of farmer(N=110)

Economic condition	Total respondent	Familiar to vaccination	Percentages familiar to vaccination
Very good	22	21	95.45%
Good	64	55	85.93%
Poor	24	4	16.66%

3.4. Get vaccines from Upazila veterinary Hospital (UVH)

Among the total respondent of the study, the proportionate prevalence of who get vaccines from UVH was 51.18% (Table 4).

Table 4: Get Vaccines from UVH (N=110)

Total study population	Get vaccines from UVH	Percentages
110	57	51.81%

3.5. People getting adequate vaccines from Upazila Veterinary Hospital (UVH)

From the table 4, we can see that people are getting vaccines from UVH at the PP of (51.81%). But the people who are getting vaccines may not be adequate for their farms. The PP of the people who are getting adequate vaccines for their farm from UVH was (40%) (Table 5).

Table 5: Get adequate vaccines from UVH (N=110)

Total study population	Get adequate vaccines from UVH	Percentages
110	44	40%

3.6. Availability of vaccines throughout the year in Upazila Veterinary Hospital

Among the total respondent of the study the proportionate prevalence (PP) of people who gets vaccines available throughout the year in Upazila Veterinary Hospital was 48.18% (Table 6).

Table 6: Vaccines available throughout the year in UVH

Total study population	Get vaccines available throughout the year	Percentages
110	53	48.18%

3.7. Maintenance of cool chain in vaccination

The proportionate prevalence of who maintain the cold chain during transportation of vaccination was (93.63%) among the respondent people of the study.

Table 7: Maintenance of cold chain

Total study population	Maintain cold chain	Percentage
110	103	93.63%

3.8. Cooperativeness of Upazila Veterinary Hospital (UVH) staff

Among the total respondent, the people who feel that the UVH is co-operative had the highest proportionate prevalence (PP) (59.09%). After that, the people who feel that the UVH is highly co-operative had the PP of 31.81%. And the PP was 9.09% of people who feel that UVH is not co-operative with them.

Table 8: Cooperativeness of Upazila Veterinary Hospital (UVH) staff

Total study population	Responded population of different criteria	Amount of responded people	Percentage
110	Highly co-operative	35	31.81%
	Co- operative	65	59.09%
	Not co-operative	10	9.09%

Discussion

4.1. Correlation between education and vaccination

The present study revealed that, the knowledge about vaccination was higher in the mostly educated people than the people having no education or minimum level of education (Table 1). From the overall study, we can say that comparatively higher educated people are more aware of vaccination of their livestock. The root cause of the awareness may be the education helps them to be attached with updated knowledge of the world through different type of media and personnel. The Facebook, Twitter, Television, Radio, YouTube etc. are connecting people by sharing the knowledge of the whole world. And unsurprisingly the educated people are mostly in touch with them, which helps them to be updated about the knowledge of vaccination of their livestock.

Previously, a study (Dutta et al., 2021) was conducted to assess the knowledge about attitudes towards practices addressing anthrax among community members in selected upazilas of Meherpur and Sirajgonj districts for the prevention and control of anthrax. According to the study, half of the respondents were illiterate (47.40%). Most of the respondents (86.32%) were self-employed with crop and livestock farming. Among the self-employed farmers, cattle (63.73%) were the highest reared animals. Among the respondents, 37.26% had no knowledge about vaccination. Respondents usually collected vaccine from quack (58.25%) (Dutta et al., 2021). There were some similarities with our present study as the illiteracy percentage and the people having no knowledge about vaccination were quite parallel to our study. As the anthrax is one of the fatal viral disease, vaccination is mostly important for it as well as other viral diseases. The study (Dutta et al., 2021) showed the proportionate prevalence of anthrax vaccine adoption by the farmers which resembles the overall condition of vaccine implementation by the farmers and that's correlates with our study.

A study was conducted by Day (Day, 2006) about vaccine side effects: fact and fiction. Where the author reported that (Day, 2006) there is increasing public interest in vaccination issues with transfer of focus from publicity over human vaccine side effects to those perceived to occur in animals. We must not lose sight of the fact that vaccination is a safe procedure that has impacted significantly on infectious disease control. Reduced population uptake of vaccination leads to re-emergence of disease in both humans and animals (Day, 2006). In present study, we found that the

uptake of vaccination by the farmers depends greatly on the awareness about the significance of infectious diseases. And the people who having decent educational background had good knowledge about the significance of vaccination and it enhances the adoption of vaccination by the farmers.

Recent research has shown that households including someone qualified to degree level are more likely to own cats than other households and they are well aware of disease prevention of the cats (Murray et al., 2010). And the research findings are relevant to our study that education of the farmers has a great significance in rearing and management of households as well as perception of vaccination.

4.2. Factors related with species

The present study reveals that, the poultry farmers were mostly aware of vaccination than the other farmers related with different species. Besides that, the majority of cattle farmers also conscious about the importance of vaccination than the goat, dog and cat owners (Table 2).

The main reason of poultry vaccination by all farmers may be due to the mortality of poultry by different kinds of viral diseases. The farmers may not be known about the diseases of poultry but they knew that some diseases are there which may cause severe mortality in their poultry farms. That's may be the important fact of vaccinating poultry in large scale by all kind of farmers. The other reasons may be that lots of pharmaceutical companies have poultry medicine and vaccine, and they have veterinary doctors as well. To increase the sale of their products they assist farmers to manage their poultry farm from day old chick until selling. As a result, farmers may be more aware of vaccination in poultry. Earlier a study was carried out by O'Brien & Zanker (O'Brien & Zanker, 2007) where they stated that mass slaughter is becoming unacceptable to society and we must move to a 'vaccinate to live' policy wherever possible. We need to use vaccines to avoid the high costs of disease and to enhance food safety. In addition, we need to ensure that the public accept the use of vaccines in food-producing animals as a means of protecting the health and welfare of all animals. In that point of view, vaccination in food producing animal can be easily accepted by the farmers to reduce the loss due to diseases.

In our study, just identical to the poultry farmers most of the cattle farmers (78.26%) were implementing vaccination to their livestock. The reason beyond this might be the educational and

economic background of the farmer. The price of the cattle is much higher than any other household livestock. The risk of loss in cattle production as well as health due to any kind of diseases makes the farmers alert of prevention of diseases and that insists them to ask the experienced farmers or any knowledgeable person regarding livestock about the preventive measures.

In the study by Sarker et al., (Sarker et al., 2020) it was observed that a mass vaccination program covered only 44% of the cattle population and 54.1% of the respondents did not bring their cattle to mass vaccination programs due to the difficulties of handling cattle and that there was no male member in the household and 12.5% of respondents acknowledged that they were not aware of the vaccine, and 3% of the respondents claimed that they ignored vaccination due to cost. In contrast to above study, our data indicating relatively higher proportion of vaccination in cattle. The reason may be we conducted in different region and in different socioeconomic background.

Our study identified that, about half of the dog and cat owners among the respondent had familiarity with vaccination. A relative study was carried out formerly, on use of a web-based questionnaire to explore cat owners' attitudes towards vaccination in cats by Habacher et al. (Habacher et al., 2010). The aim of this study was to develop a better understanding of the factors involved in cat owners' decisions related to vaccination and to explore their views and knowledge of vaccination. Where the author stated that, owners who perceived the severity of infectious diseases or veterinary advice as very important were more likely to vaccinate their cats than owners who perceived these factors as less important. This statement has a positive correlation with our study findings. The people who had knowledge about the severity of diseases were more concerned about the implementation of vaccines to their households. The low vaccination in small animal may be the fact that the owner in rural areas are not aware of the diseases and their severity in small animal which can be prevented by vaccination.

With day-to-day veterinary practice in mind, practical issues are stepping out includes kitten vaccination, passive immunization, and prevention strategies in populations and crowded cat communities (Horzinek & Thiry, 2009). This updated knowledge among the pet owner increases the awareness about vaccinating their dog or cats which acts as a key factor in changing their perception in adoption of vaccination.

In a previous study in UK, overall 77.9% of animals had recorded vaccinations. The percentage of animals with recorded vaccinations was higher in dogs, neutered animals, in insured dogs and cats and in purebred dogs. In the vaccinated population, cats received more core vaccines per year of life (0.86) than dogs (0.75). This descriptive study suggests a substantial proportion of animals are not benefiting from vaccine protection (Sánchez-Vizcaíno et al., 2018). So, it is clear that high income countries people are getting more vaccination than the poor country people as they have good economical background and their education helps them to be up to date on vaccination issue.

4.3. Economic condition of farmer

The present study indicated that, the owners who had very good or good economical background were mostly acquainted to vaccination. In contrast, economically poor people had less familiarity with vaccination of their livestock (Table 3).

The study revealed that the economically strong people had more familiarity about vaccination. This might be due to their good social relations with veterinary service providers and access to veterinary services nearby to them. Good economical background always acts as a positive factor of rearing livestock as they get proper veterinary services when they needed. Farmers get up to date information of products and services with proper suggestion. In contrast with that of the people having poor economic background were less familiar to livestock vaccination. They might not get adequate suggestion or proper veterinary services. It might be the reason of not being familiar with adoption of vaccination. The study also showed that the cost of vaccination also had a significant effect on vaccination which suggest why poor people had low vaccination rate to their livestock.

Our data are in accordance with the previous studies related with vaccination of animals on various diseases by (Rume et al., 2016) and (Thapa et al., 2014) where they stated that the poor coverage of vaccination uptake was also observed in most of the low-income people as well as low income countries where livestock is reared by households.

4.4. Vaccines from Upazila Veterinary Hospital (UVH)

The study revealed that approximately just above half of the respondent people (51.18%) were getting vaccines from Upazila Veterinary Hospital in Sherpur. This number of people is not much higher as the prevalence of respondent farmers being familiar with vaccination. There might be many causes of not getting vaccines properly from UVH. For example, lack of availability of adequate vaccines in UVH, inadequate cooperation from UVH and inadequate manpower to provide route level service.

In recent years, a study was conducted by Sarker et al. on maximization of livestock vaccination coverage in Bangladesh (Sarker et al., 2020). The study found that all of the respondents from livestock personnel agreed that manpower was not enough to cover the total area. For an effective vaccination program, 58.33% of respondents recommended door-to-door service. Thus, regular campaigns with door-to-door vaccination services are suggested to control disease outbreaks in Bangladesh (Sarker et al., 2020). As our study findings showed that the amount of people getting vaccines from UVH is moderate, so UVH should raise door to door vaccination programme to cover the whole population under vaccination. The people who are economically underprivileged have very minimum idea about getting vaccinated their households. So, to control the disease outbreak in the area UVH should increase their manpower and door to door service for awareness of the farmers and make sure the households are under proper vaccination.

4.5. Availability of vaccines throughout the year in Upazila Veterinary Hospital

Among the total respondent of the study, around half of the respondents stated that they get vaccines available throughout the year from UVH. There might have following reasons of not having adequate vaccines throughout the year. The demands of the area covered by the UVH might be higher than the monthly supply of the vaccines could be an important factor in this case. The transportation facility of importing vaccines at the upazila also be a good factor of not getting vaccines regularly from UVH. The proper collaboration between UVH and farmers could be the key factor to make the adoption of vaccines properly by supplementation of vaccines when the needed.

4.6. Maintenance of cool chain in vaccination

Almost all study people maintains the cold chain during transportation of vaccination. Cool chain maintaining of the vaccines is one of the most important factors for successful vaccination to an animal. It might be due to the suggestion by Vet personnel or by UVH staff. The cool chain maintaining mostly helps to maintain the effectiveness of vaccination and that's why the vaccines supplied from the UVH with ice packaging. The farmers who get vaccines from middleman or other shops or from quack might have similar knowledge in maintaining the cool chain during transportation of vaccination.

A previous study by (Kumar et al., 2017) on advances in peste des petits ruminants vaccines ; reported that, maintenance of cold chain is essentially required for transportation of the vaccine in the field but which may significantly increase the overall cost of vaccine package. Therefore, for successful vaccination cool chain maintaining is a must because the viability of vaccines can be hampered if proper cool chain isn't maintained, and our present study suggest that farmers had a positive correlation with maintaining the cool chain during vaccination.

4.7. Cooperativeness of UVH and Constrains in adoption of vaccination by farmers

Among the total respondent of our study, majority of the people stated that UVH was co-operative with them and very few respondents (Table 7) feel that UVH was not co-operative with them. The thought of the people might differ due to their behavioral perception. The people having good educational background perceives the full advantages from the veterinary hospital because of their way off approaching. In contrast, the poor illiterate people didn't know the proper way of approaching and there creates a gap or miscommunication between the farmers and the UVH.

A recent study by Hopker et al. (Hopker et al., 2021) reported that, there was no significant association between the age or gender of respondent and the immunization of their livestock. Common barriers to immunization were: negative attitudes to vaccination; lake of knowledge about vaccines; lack of awareness of date and time of vaccination events; and difficulty presenting animals.

Our study revealed that lack of knowledge about vaccination were the major constrains in adoption of vaccination. In a previous study, some constrains of adoption of vaccination were also reported as vaccination causes reduce in milk production, vaccination causes infertility in animals, swelling at the site of vaccination, vaccination causes fever in animals, recurrence of disease even after vaccination, non-availability of veterinarians or skilled staff, poor infrastructure of store vaccine etc. (Rathod et al., 2016).

Conclusion

The key message from our study is that education is the most important factor in relation to animal vaccination in Bangladesh. In addition, socio-economic condition of the farmers also acts as a major factor in successful animal vaccination. UVH staff members were mostly cooperative, however, lack of manpower and in adequate vaccine supply cause poor vaccination coverage. In future a large scale study is recommended for better understanding of factors related to successful vaccination in animals in Bangladesh.

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Appendix-I

(Questionnaire to identify the risk factors of animal vaccination in Bangladesh)

Farmer section

Id no.....

1) Name of the farmer: 2) Age(optional):

3) Contact no(optional):

4) Educational background of farmer:

1)Primary	2)High school
3)College or diploma	4)Undergraduate or higher
5)No education	6)Do not want to disclose

5) Location of the farm:

6) Species:

7) Size of the farm:

- a) 3-6
- b) 7-15
- c) 15-30
- d) More than 30
- e) Others:

8) Years of farming:

9) Economic condition of the farmer:

10) Do you know about vaccination? Yes/No

11) Have you attended any vaccination training? Yes/No

12) Do you know what vaccines should be given to your animal? Yes/No

13) Do you know where to get vaccine? Yes/ No

14) Do you get vaccines from upazila livestock office? Yes/No

15) Do you get adequate vaccines available in the Upazila livestock office? Yes/No

- 16) Do you regularly vaccinate your animal? Yes/No, if no, why?
- 17) Do you think vaccination is good for animal? If no, why?
- 18) Do the Upazila livestock office is co-operative to give vaccine to farmers?
 - a) Highly co-operative
 - b) Co-operative
 - c) Not co-operative

Upazila veterinary hospital section

19) What vaccines are available in the upazila livestock office?

- ❖
- ❖
- ❖
- ❖
- ❖
- ❖
- ❖
- ❖
- ❖

20) Do the vaccines are available throughout the year? Yes/No

21) Do you maintain cold chain? Yes/No

22) Do you arrange any vaccination programme to raise awareness among farmers? Yes/No

23) How do you maintain uninterrupted electricity supply during electricity outage for long time?

- a) Generator
- b) No back up electricity supply for running the fridge

24) Which farmers are getting those vaccines from upazila livestock office?

- a) Educated
- b) Medium educated
- c) Illiterate

25) Problems behind not getting vaccine properly:

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Biography

The author, **Md. Mahfuzur rahman**, Son of Md. Motaleb Ali and Mursheda parvin was born on January 25, 1997 at Sherpur sadar, Sherpur. He passed his Secondary School Certificate (SSC) Examination in 2012 (GPA-5.00) followed by Higher Secondary Certificate (HSC) Examination in 2014 (GPA-5.00) from Dhaka board. He is now enrolled in year-long internship programme for completion of Doctor of Veterinary medicine in Chattogram Veterinary and Animal Sciences University (CVASU), Chattogram, Bangladesh. In future he would like to do Research work about animal welfare, epidemiological study and Zoonotic diseases those take public health significance in the world regarding one health constitution.