

ORIGINAL ARTICLE
RUMINANTS

A survey on the knowledges, attitudes, behaviours and practices of goat farmers about peste des petits ruminants disease in goats at Haor and bordered areas in Sylhet district of Bangladesh

Sumaya Shargin Khan¹  | Hemayet Hossain²  | Sohag Talukder²  |
Md. Saif Uddin³ | Md. Anwar Uddin⁴ | Md. Saiful Islam Siddiqui² 

¹ Internship student, Faculty of Veterinary, Animal & Biomedical Science, Sylhet Agricultural University, Sylhet, Bangladesh

² Department of Anatomy & Histology, Faculty of Veterinary, Animal & Biomedical Science, Sylhet Agricultural University, Sylhet, Bangladesh

³ Livestock Extension Officer, Upazilla Livestock Office and Veterinary Hospital Jaintapur, Sylhet, Bangladesh

⁴ Livestock Extension Officer, Upazilla Livestock Office and Veterinary Hospital Kanaighat, Sylhet, Bangladesh

Correspondence

Md. Saiful Islam Siddiqui, Department of Anatomy & Histology, Faculty of Veterinary, Animal & Biomedical Science, Sylhet Agricultural University, Sylhet-3100, Bangladesh.
Email: msisiddiqui2000@yahoo.com

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Abstract

Background: Contagious and economically devastating, peste des petits ruminants (PPR) is a viral disease affecting goats and sheep, causing significant losses in livestock productivity and posing a threat to food security and rural livelihoods worldwide.

Objectives: This study was conducted to assess the status of goat farmer's knowledge, attitude and practice (KAP) about PPR disease at Sylhet district of Bangladesh.

Methods: A comprehensive cross-sectional survey, conducted over 11 weeks, targeted 130 goat owners. Following a pilot study with 20 farmers, a set of 17 validated questions on PPR KAP was validated. Data collection was performed through face-to-face interviews by a trained team using KOBO Toolbox, with interpretation of responses based on established thresholds for knowledge (>65%), attitude (>75%) and practice (>70%).

Results: Overall, 67.7% of participants demonstrated a good level of knowledge about PPR disease. Males exhibited 1.42 times higher odds of knowledge compared to females (odds ratio = 1.42). The middle age group (31–45 years) showed significantly higher knowledge levels (83.3%, $p < 0.001$). Within this age group, positive practice levels were also notably higher (54.8%). Those with a higher secondary education background exhibited the most positive practice levels (>80%). Participants whose additional income came from non-governmental organization employment showed a higher positive practice level (71.4%), 1.46 times higher than other income sources.

Conclusion: Strategic interventions should prioritize female farmers, educational empowerment and collaboration with non-governmental organizations to bolster livestock health and rural livelihoods in Bangladesh as part of national PPR control strategy to fulfil the goals of Office International des Epizooties/World Organization

Sumaya Shargin Khan and Hemayet Hossain equally contributed to this article.

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for Animal Health (OIE/WOAH) and Food and Agriculture Organization (FAO) PPR eradication by 2030.

KEYWORDS

control, demography, PPR disease, survey, virus

1 | INTRODUCTION

Sylhet is the eastern divisional zone of the country, which shares a huge area to the neighbouring country India with its few sub-districts, such as Zakiganj, Kanaighat, Jaintapur, Gowainghat and Companiganj (Asha et al., 2024). Few land port such as Tamabil (Gowainghat, Sylhet), Sheola (Beanibazar, Sylhet) and Bholaganj (Companiganj, Sylhet) plays important role in bilateral trade between Bangladesh and India. Animal trespass from India to Bangladesh frequently takes place without following animal trespass act and proper quarantine, which facilitates the transmission of transboundary and Office International des Epizooties (OIE) notifiable animal diseases like peste des petits ruminants (PPR) (Office International des Epizooties [OIE]/World Organization for Animal Health, 2008). Due to sharing large bordered areas to neighbouring country – India, illegal trespass of animals is a common and irresistible issue, which aggravates PPR virus transmission badly (Siddiqui et al., 2023). Flash flood is the crucial natural calamity in these areas as bordered and hilly areas; adjacent to Meghalaya mountains of India. Natural calamities like flash flood in one sense destroy crops; on the other hand, long-term stagnation of water hampered the total agricultural system (Centre for Effective Governance of Indian States [CEGIS], 2012). In these circumstances, goat rearing might be the alternative to crop production. One of the major constraints of goat rearing in Bangladesh perspectives including Haor belt is the PPR disease, whose morbidity and mortality are high, caused by Morbilli virus characterized by high fever, stomatitis, oculo-nasal discharge, pneumonia, diarrhoea and death (Chowdhury et al., 2014). Since 1993, PPR is endemic in Bangladesh (BLRI, 2021) and causes huge economic loss US\$25 million annually (Rahman et al., 2021).

knowledge, attitude and practice (KAP) surveys, first developed in the 1950s in the context of family planning and population studies, KAP surveys are an acronym for knowledge, attitude, behaviour and practices (Yasin et al., 2019). Subsequently, these surveys have been integrated as a method covering a broad range of health-related behaviour and health-seeking practices. The KAP survey samples are designed to be representative of the selected target population. They attempt to answer what people in the population know (Knowledge), believe (Attitude) or do (Practice) about the subject. Data are collected through the administration of structured or semi-structured questionnaires, which can be completed by the respondents themselves or elicited by interviewers, to collect both qualitative and quantitative data (Andrade et al., 2020; Jacobsen, 2016).

Low-lying hill oriented areas normally serve as a small Haor, Baor, and Jheel particularly in the rainy season due to incessant rains and heavy downstream current (Reliefweb, 2022). The people of these areas are continuously facing such calamities. Due to poor communi-

cation, they receive inadequate veterinary service. In this situation, to overcome the PPR problem, there is no alternative to increase mass awareness of goat farmers about PPR disease. For this, estimation of status of existing knowledge, beliefs and practices of the farmers is the prerequisite. Therefore, this study was conducted to assess the status of goat farmer's knowledge about PPR disease, as well as to investigate the level of awareness among farmers about PPR disease treatment, control and prevention at Haor areas of Sylhet district.

2 | MATERIALS AND METHODS

2.1 | Ethical consideration

Ethical considerations were paramount throughout the KAP survey. Participants provided informed consent, ensuring they understood the study's purpose and their rights. Confidentiality measures were strictly implemented to protect participants' privacy, and efforts were made to minimize any potential harm or discomfort. Cultural sensitivity was maintained throughout, and the study aimed to benefit the community by advancing knowledge and informing future interventions.

2.2 | Survey region

The study areas were selected on the basis of zoo-geography and demography of bordered Haor (wet land) area of Sylhet district. The study areas were Zakiganj, Kanaighat, Jaintapur, Gowainghat and Companiganj sub-districts of Sylhet district in Bangladesh, as shown in Figures 1A–C and 2.

2.3 | Study design and target population

The cross-sectional survey spanned 11 weeks, running from July to September 2023, following the established 'KAP Survey Model' proposed by United States Agency for International Development (USAID) (2011). This investigation leveraged the foundational research established by Ozturk et al. (2019) in their KAP survey model, enhancing the study's framework and methodology.

Respondents were chosen based on fulfilling a minimum of two inclusion criteria:

1. Owning a minimum of five goats.
2. Residing and farming in areas adjacent to bordered Haor (wetland) regions.

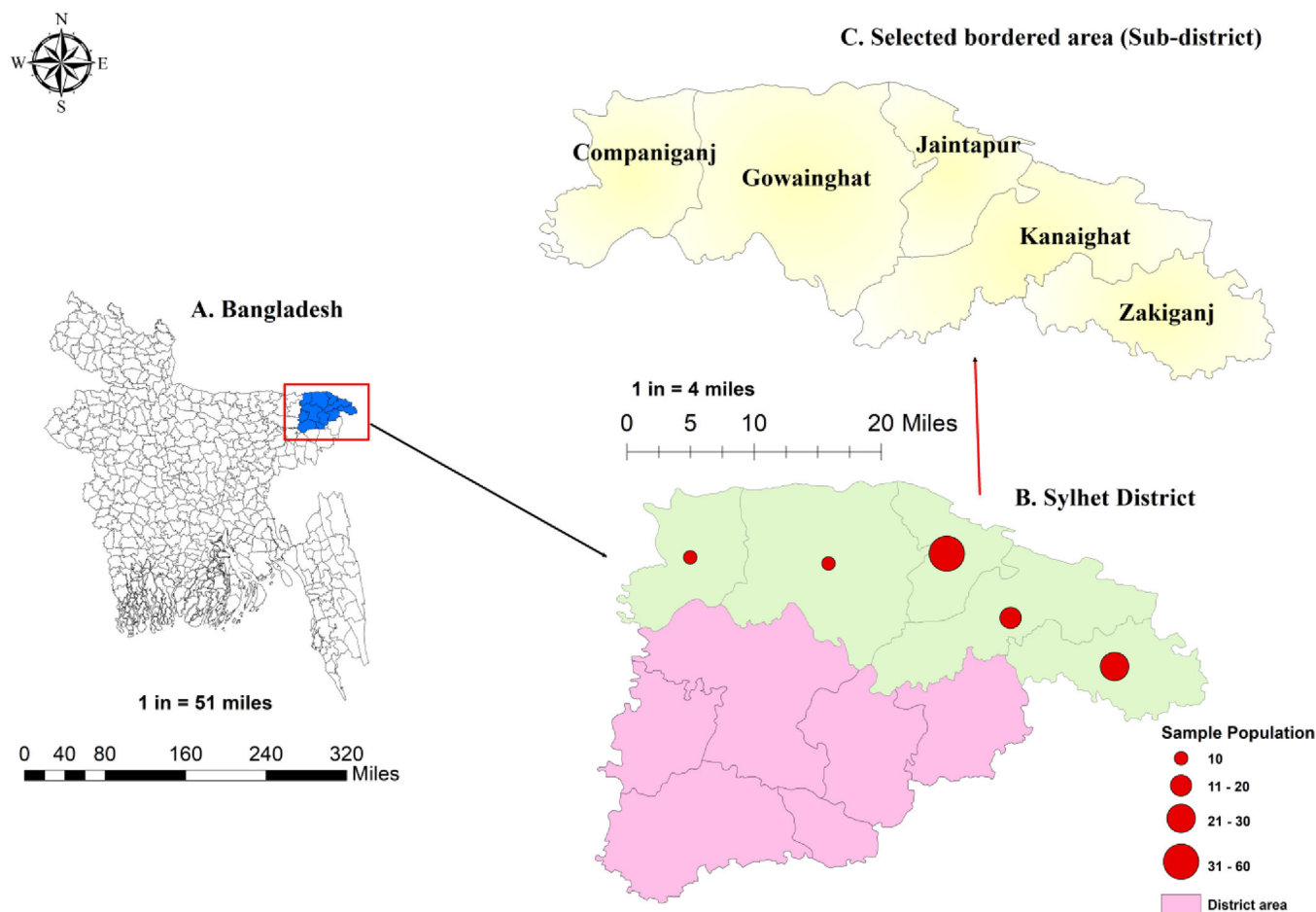


FIGURE 1 Geo-spatial mapping showed the selected bordered area (Study area) of Sylhet district in Bangladesh. The map was created using ArcMap 10.7 (Esri). (A) Administrative boundary of Bangladesh. (B) Sylhet district boundary and number of sampling population. (C) Bordered area (Study area) of Sylhet.

Participation in the survey was entirely voluntary, with no coercion or incentives offered to respondents. A total of 130 respondents were fulfilled the inclusion criteria. So, the sample size was determined using Slovin's formula described by Israel in 1992.

$$n = \frac{N}{1 + N(e)^2}$$

where n is the required of sample size; e is the level of precision (0.05); N is the population size; confidence level was assumed at 95%.

This study focused exclusively on the bordered and Haor areas, with the population size estimated using minimum criteria. Out of the individuals meeting the inclusion criteria, 130 respondents were selected ($N = 130$). Using the formula, the minimum required sample size was calculated to be 98 ($n = 98$). Given the low sample size, the study included all 130 criteria-based selected farmers as respondents.

2.4 | Surveyors

Six surveyors organized into two teams, where each team consisted of three members (one interviewer, one data collector and one for

observation), served as data enumerators for this investigation. All enumerators received thorough training over a 2-day period, focusing on the specific objectives of the survey. These surveyors were veterinarians with expertise relevant to the study's aims. A lead supervisor was responsible for overseeing the enumerators and managing the entire investigation.

2.5 | Survey method

Initially, a pilot study was undertaken involving 20 goat farmers to assess the clarity, reliability and validity of the questionnaire. Following team discussions and analysis of pilot results, the questionnaire underwent revisions, resulting in a final set of 17 validated questions for the survey: 6 pertaining to knowledge, 5 to attitude and 6 to practice. The questions comprised both open and closed formats, including multiple-choice and Likert scale responses. For data collection, respondents were interviewed face-to-face by trained surveyors. Each surveyor had a specific role: one posed the questions, another recorded responses using Kobo Toolbox (www.kobotoolbox.org), whereas a third observed the interview process. Interviews were

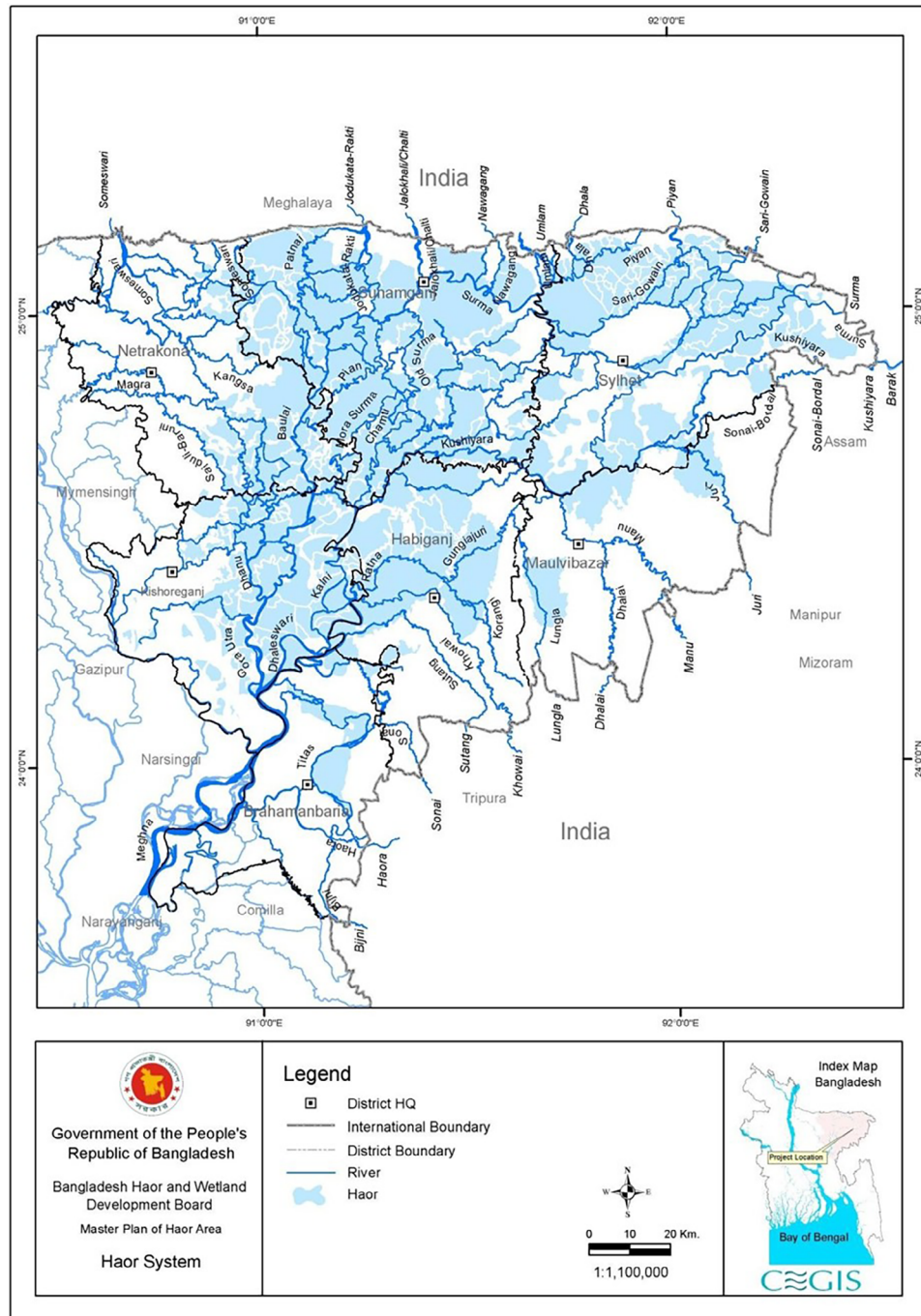


FIGURE 2 Haor of North East Region of Bangladesh. Sky-blue colour indicates the Haor areas. *Source:* Photo taken from CEGIS.

conducted in the local language to ensure clear communication and understanding among respondents.

2.6 | Interpretation of KAP measures

The interpretation of KAP measures was closely followed (Firouza-badi & Mahmoudi, 2020; Tegagn et al., 2017) with minor adjustments. For knowledge on PPR, respondents were deemed knowledgeable if they provided more than 65% affirmative answers on the sub-

ject. Attitude level was determined by considering 75% of affirmative responses, whereas practice level was assessed based on 70% affirmative responses.

2.7 | Statistical consideration

All the data were primarily assessed, sorted and recorded in excel 2013. First, descriptive statistics and chi-square tests were utilized to examine the demographic characteristics of the participants. Then,

TABLE 1 Socio-demographic characteristics of farmers (n = 130) regarding the knowledge, attitude and practice (KAP) survey of peste des petits ruminants (PPR) disease in goat at bordered area of Sylhet, Bangladesh.

Demographic characters	Explanatory variable	No. of participant	% (95% CI)	χ^2 Value	p-Value
Gender				37.7	<0.001
	Male	30	23.08 (16.14–31.28)		
	Female	100	76.92 (68.72–83.86)		
Age (Years)				63.2	<0.001
	15–30 years	15	11.54 (6.60–18.32)		
	31–45 years	42	32.31 (24.38–41.07)		
	46–60 Years	65	50.00 (41.11–58.89)		
	Above 61 years	08	6.15 (2.69–11.77)		
Education				286	<0.001
	Illiterate	10	7.69 (3.75–13.69)		
	Primary	103	79.23 (71.24–85.84)		
	Secondary	06	4.62 (1.71–9.78)		
	Higher secondary	06	4.62 (1.71–9.78)		
	Graduation and higher	05	3.85 (0.54–7.15)		
Occupation				88.6	<0.001
	Agriculture	92	70.77 (62.15–78.41)		
	Business	31	23.85 (16.81–32.11)		
	NGO jobs	07	5.38 (2.19–10.78)		
Farmer type				32.4	<0.001
	Small (<5 goat)	55	42.31 (33.70–51.28)		
	Medium (5–10)	62	47.69 (38.86–56.63)		
	Large (Above 10)	13	10.00 (5.43–16.49)		

Abbreviations: CI, confidence interval; NGO, non-governmental organization; χ^2 , chi-square Goodness of Fit Test.

univariate analysis using chi-square tests and multivariate regression analysis was performed to assess the relationship between individual variables and the levels of KAP regarding PPR disease. An odds ratio (OR) greater than 1 indicates better odds of KAP compared to the reference (control) group, whereas an OR less than 1 indicates that the control group is better. An OR of 1 indicates no difference, meaning the variable has the same value as the control (Hoque et al., 2023).

Additionally, Spearman correlation analysis explored correlations among different KAP levels. To visually represent the interconnectedness of KAP measures, a Venn diagram was created using OriginPro software (Hoque et al., 2023). Furthermore, descriptive statistics were employed on the questionnaire responses for comprehensive analysis. All statistical analyses were conducted using SPSS v26 software, with a significance level set at $p < 0.05$ to ensure the validity of our findings.

3 | RESULTS

3.1 | Demographic information

The demographic characteristics of the respondents are shown in Table 1. Analysis of demographic parameters showed that significant

proportions of the participants were female (76.92%; 100 out of 130), belonging to the 46–60 years age group (50.0%; 65 out of 130), with education levels up to primary (79.23%; 103 out of 130) and identified as medium-scale farmers with 5–10 goats (47.69%; 62 out of 130).

3.2 | PPR Knowledge level

The knowledge domain with corrected answers of participants calculated is displayed in Table 2. Overall, knowledge level of participants was 67.7% (88/130). Among the total participants, Knowledge level of male was 1.42 times (OR = 1.42, $p = 0.23$) higher than female and is about 76.7%. About two-third participants of age group (31–45 Year) had significant ($p = 0.001$) knowledge about PPR disease. This indicates middle-aged people were likely to had greater knowledge level (83.3%) about PPR disease. Education level had a significant impact on knowledge levels. The percentage of knowledge level of farmers on PPR disease is increased with higher education levels. Graduation and those with higher education had the highest knowledge levels (100%). The multivariate analysis and χ^2 test both confirmed that education is a significant predictor of knowledge about PPR disease ($p < 0.001$). It suggests that education is a strong determinant of

TABLE 2 Knowledge estimates of farmers regarding peste des petits ruminants (PPR) disease.

Demographic characters	Predictor	Desired response (%)	Multivariate analysis		χ^2 Test
			OR	p-Value	p-Value
Gender					0.23
	Female	65 (67.7	1		
	Male	23 (76.7	1.4218	0.158	
	Total	88 (67.7			
Age (Years)					0.001
	15–30 years	9 (60.0	1		
	31–45 years	35 (83.3	1.8587	0.066	
	46–60 years	43 (66.2	0.7618	0.448	
	Above 61 years	1 (12.5	0.0938	0.925	
Education					<0.001
	Illiterate	1 (10.0	1		
	Primary	70 (68.0	2.5827	0.011	
	Secondary	6 (100.0	3.1843	0.002	
	Higher secondary	6 (100.0	2.6022	0.010	
	Graduation and higher	5 (100.0	2.2004	0.030	
Occupation (secondary income source)					0.006
	Business	14 (46.7	1		
	Agriculture	67 (72.0	2.4080	0.018	
	NGO jobs	7 (100.0	0.9055	0.367	
Farmer type					0.075
	Medium	43 (69.4	1		
	Small	33 (60.0	–0.4042	0.687	
	Large	12 (92.3	1.5136	0.133	

Abbreviations: CI, confidence interval; NGO, non-governmental organization; χ^2 , chi-square Goodness of Fit Test.

knowledge about PPR disease. There was a greater knowledge level observed in participants in occupational group (NGOs and agriculture as second income generation source) and that is 100 and 72.0 percentages, respectively. Statistical analysis revealed that participants of occupational group had significant knowledge level about PPR disease ($p = 0.006$). Types of farmers (medium, small and large) had a direct impact on knowledge level of PPR disease. Participants who rear goats mainly for commercial purpose showed a better knowledge level (92.3%) about PPR disease. On the other hand, farmers who rear goats only for livelihood purposes had the least knowledge level (60.0%) about PPR disease (Table 2). It implies that type of farmers had a significant influence on knowledge levels of farmers about PPR disease ($p = 0.075$). The knowledge level questions were analysed and shown in Table 3.

3.3 | Attitude and practice measures

A summary of respondents' attitudes towards the PPR disease is shown in Table 4. Both men and women showed a moderate attitude

response to the PPR disease (44% & 43.3%); however, men appeared to have 0.17 times ($OR = 0.17$) more positive attitude than women did. Interestingly, like knowledge level, the rate of positive attitudes towards the disease was higher in age group of 31–45 year (69%). However, the attitude level of respondents towards the PPR disease was shown to be significantly predicted by age variation of respondents, as validated by both the χ^2 test and linear regression analysis ($p < 0.001$) (Table 4). This indicates that the respondents' age is a significant factor in determining the attitude level of participants about the PPR disease.

According to the multivariate analysis, persons with higher education levels and graduation rates had the highest proportion of positive attitude (80%) towards the PPR disease and it is 2.66 times ($OR = 2.66$, $p = 0.009$) higher than illiterate respondents. Persons associated with agriculture had a more favourable perspective towards the disease (50%) than illiterates and persons working for non-governmental organizations as secondary income source. In addition, statistical analysis showed that respondents' occupational status is a significant indicator of their attitude level ($p = 0.03$). Respondents who were large scale farmers (61.5%) had a more positive attitude response to the PPR

TABLE 3 Descriptive statistics of knowledge level questions.

Survey measures	Question and response (frequency, %)
Knowledge	Q1. Do you know about the PPR disease?
	Yes: 126 (96.92%)
	No: 4 (3.08%)
	Q2. What is the clinical signs c of PPR?
	Yes: 109 (83.84%)
	No: 21 (16.15%)
	Q3. Can PPR be confused with other disease?
	Yes: 72 (55.38%)
	No: 58 (44.61%)
	Q4. How PPR is diagnosed in goat?
	Yes: 67 (51.53%)
	No: 63 (48.46%)
	Q5. What is the mortality rate (range) of PPR?
	(10–30): 26 (20.00%)
	(30–50): 37 (28.46%)
	(50–70): 53 (40.76%)
	(Above 70): 14 (10.76%)
	Q6. Have any specific risk factors for PPR transmission?
	Strongly disagree: 21 (16.15%)
	Disagree: 32 (24.62%)
	Neutral: 47 (36.15%)
	Agree: 17 (13.08%)
	Strongly agree: 13 (10.0%)

disease than medium and small-scale farmers (48.4%, 34.5%). The attitude level questions were analysed and shown in Table 5.

According to Table 6, the total practice level of participants was 40.8%. Women were more likely than men to have a positive practice level toward the PPR disease (42.0%). In age group, respondents had low to moderate level of practice level towards the PPR disease (12.5%–54.8%). Nonetheless, compared to the 15–30 year age group, respondents in the 31–45 year age group had a higher positive practice level (54.8%), and this difference was 0.9587 times higher. Linear regression analysis revealed that participants with a higher secondary educational background had the most positive practice level to the PPR disease (>80%), which is 0.65 times (OR = 0.6555) higher than the illiterate group. Non-governmental organization employees appeared to have a more positive practice level (71.4%) towards the PPR disease, which is 1.45 times (OR = 1.45) higher than that of the business group. Nonetheless, a significant factor influencing participants' level of PPR disease practices is the type of farmer. Large-scale farmers were found to have a significant positive practice level for the PPR disease (p -value, 0.0003), according to multi variate analysis and the χ^2 test (Table 6). The attitude level questions were analysed and shown in Table 5 and 7.

3.4 | Relationship among KAP attributes

The Venn diagram encapsulates the diverse responses regarding KAP concerning PPR disease in goats (Figure 3). Notably, 26 respondents demonstrate a holistic understanding by possessing knowledge, attitude and implementing preventive measures (Figure 3). Another 26 individuals demonstrate both knowledge and a positive attitude towards disease prevention, reflecting an informed perspective; however, they lack practical implementation. Furthermore, 16 respondents showcase both knowledge and practice without accompanying attitude, suggesting a functional understanding but potential gaps in recognizing the importance of preventive measures. Intriguingly, one respondent demonstrates a positive attitude towards prevention efforts and actively engages in practices, yet lacks comprehensive knowledge about PPR disease. Conversely, 20 respondents possess knowledge without a corresponding attitude or practice, signifying a disconnect between awareness and action. Additionally, four individuals display a positive attitude towards prevention but lack both practical measures and in-depth understanding. Lastly, 10 respondents engage in preventive practices without substantial knowledge or a positive attitude, emphasizing the importance of

TABLE 4 Attitude level of farmers regarding peste des petits ruminants (PPR) disease.

Demographic characters	Predictor	Desired response (%)	Multivariate analysis		χ^2 Test
			OR	p-Value	p-Value
Gender					0.949
	Female	44 (44.0)	1		
	Male	13 (43.3)	0.1755	0.861	
	Total	57 (43.8)			
Age (Years)					<0.001
	15–30 years	5 (33.3)	1		
	31–45 years	29 (69.0)	1.8317	0.070	
	46–60 years	23 (35.4)	−0.7698	0.443	
	Above 61 years	0 (0.0)	−0.1406	0.888	
Education					0.029
	Illiterate	0 (0.0)	1		
	Primary	47 (45.6)	1.4911	0.139	
	Secondary	3 (50.0)	1.4541	0.149	
	Higher secondary	3 (50.0)	1.4502	0.150	
	Graduation and higher	4 (80.0)	2.6682	0.009	
Occupation (secondary income source)					0.033
	Business	7 (23.3)	1		
	Agriculture	47 (50.5)	2.4454	0.016	
	NGO jobs	3 (42.9)	−0.7529	0.453	
Farmer type					0.128
	Medium	30 (48.4)	1		
	Small	19 (34.5)	−2.1038	0.038	
	Large	8 (61.5)	0.2284	0.820	

Abbreviations: CI, confidence interval; NGO, non-governmental organization; χ^2 , chi-square Goodness of Fit Test.

comprehensive education and mindset shifts in disease management strategies.

The correlation matrix scatter plot illustrated the connections between KAP attributes. The Spearman correlation coefficient of 0.41 signified a moderate positive correlation between knowledge and attitude, whereas the value of 0.238 indicated a weak positive correlation between practice and knowledge. Conversely, there was a negligible relationship observed between attitude and practice. Additionally, the histogram within the correlation matrix depicted participants categorized as having either 'yes' or 'no' for knowledge, attitude and practice (Figure 4).

4 | DISCUSSION

This study is the first report describing the role of the study areas in the dissemination of trans boundary disease like PPR geographically, as bordered and Haor oriented areas and that facilitate illegal trespass of animals and also inter-connectedness of each participants (farmers) and their demography and the knowledge, attitudes and practices

towards PPR disease, which also supports the findings of a study conducted by Li et al. (2015) and Rahman et al. (2021), who stated that outbreaks of PPR in Guangdong province, southern China, are closely related to illegal cross-regional importation of goats. The study goal was to study the real determinant or factors of the study area's (as hilly and Haor oriented areas) and farmer's related to PPR dynamics, which is the prerequisite for the formulation of effective prevention strategies, the findings of this study also support the study conducted by Gao et al. (2019). Study revealed that significant percentages of farmers of different categories, particularly those who rear goats only for livelihood purposes, had least knowledge level (60.0%) about PPR disease. Therefore, the findings are in accordance the strategy taken by Food and Agriculture Organization (FAO) and OIE World Organisation for Animal Health (WOAH) 2016 in peste des petits ruminant's global eradication program. Bangladesh Livestock Research Institute (BLRI) has formulated a PPR control model according to OIE guidelines and published a manual where they included training of the goat farmers as a component (third component) of the model, which also supports the findings of this study. Another study conducted by Islam et al. (2021) stated that 58% of total respondents bear inadequate knowl-

TABLE 5 Descriptive statistics of attitude level questions.

Survey measures	Question and response (frequency, %)
Attitude	Q1. How confident are you in recognizing PPR symptoms?
	Strongly confident: 7 (5.38%)
	Confident: 15 (11.53%)
	Unconfident: 78 (60.00%)
	Neutral: 30 (23.07%)
	Q2. How strongly do you believe that PPR vaccination is cost-effective for you?
	Strongly disagree: 16 (12.31%)
	Disagree: 37 (28.46%)
	Neutral: 15 (11.54%)
	Agree: 32 (24.62%)
	Strongly agree: 30 (23.08%)
	Q3. How willing are you to collaborate with neighbouring farmers to control PPR spread?
	Not at all willing: 13 (10.0%)
	Neutral: 43 (33.08%)
	Willing: 47 (36.15%)
	Moderately willing: 13 (10.0%)
	Extremely willing: 14 (10.77%)
	Q4. How crucial do you consider reporting of suspected PPR cases for disease control?
	Not at all important: 8 (6.15%)
	Neutral: 23 (17.69%)
	Moderately important: 32 (24.62%)
	Very important: 41 (31.54%)
	Extremely important: 26 (20.0%)
	Q5. Are you willing to adopt bio-security measures to prevent PPR introduction?
	Yes: 49 (37.69%)
	No: 32 (24.61%)
	Neutral: 49 (37.69%)

edge about zoonotic tuberculosis in Bangladesh. In a study conducted by Dutta et al. (2021) about anthrax of cattle, the study areas were Meherpur and Sirajgonj and it is found that 37.26% farmers had no knowledge about anthrax, though in this study 67.7% farmers are well aware about PPR disease. The difference might be due to PPR endemic status in Bangladesh since 1993, farmers are continuously facing the situation and the disease causes huge economic loss.

Annual rainfall is much higher in Sylhet district due to geographical location; therefore, in early monsoon, usually the small animals are kept indoor, and this gathering and confinement are the important stressor, which may facilitate PPR virus transmission. In that particular time, to check the situation, improvement of the level of farmers' knowledge, attitude and good practices may be the only effective way to get rid of the problem, which is also supported the findings of Rahman et al. (2021). Rahman et al. (2021) also identified the 14 districts including Sylhet as hot spot or high risk zone and suggested controlling of animal movement from high risk zone to low risk zone and strategic vaccination during or just prior to animal movements

as regulation of animal movement within country or trans boundary movement is very tough, particularly during festival time. All the suggestions and strategy are very important for formulation of national PPR control program and directly or indirectly incorporated to the status of farmer's awareness, which is the main thematic matter of this study.

5 | CONCLUSION

In summary, this study highlights the KAP of goat farmers regarding PPR disease in Sylhet District, Bangladesh. The findings suggest a need for targeted interventions to improve awareness and management practices, particularly among female farmers. Educational empowerment and collaboration with non-governmental organizations are crucial for promoting positive practices and aligning with national and global PPR control strategies. Continuous monitoring and evaluation are essential to track progress towards the goal of PPR

TABLE 6 Practice level of farmers regarding peste des petits ruminants (PPR) disease.

Demographic characters	Predictor	Desired response (%)	Multivariate analysis		χ^2 Test
			OR	p-Value	p-Value
Gender					0.602
	Female	42 (42.0)	1		
	Male	11 (36.7)	-0.5447	0.587	
	Total	53 (40.8)			
Age (Years)					0.056
	15–30 years	7 (46.7)	1		
	31–45 years	23 (54.8)	0.9587	0.340	
	46–60 years	22 (33.8)	-0.4973	0.620	
	Above 61 year	1 (12.5)	-0.7692	0.443	
Education					0.115
	Illiterate	2 (20.0)	1		
	Primary	40 (38.8)	0.0932	0.926	
	Secondary	3 (50.0)	-0.3146	0.754	
	Higher secondary	5 (83.3)	0.6555	0.513	
	Graduation and higher	3 (60.0)	-0.3165	0.752	
Occupation (secondary income source)					0.182
	Business	10 (33.3)	1		
	Agriculture	38 (40.9)	0.3493	0.727	
	NGO jobs	5 (71.4)	1.4555	0.148	
Farmer type					0.003
	Medium	23 (37.1)	1		
	Small	19 (34.5)	-1.0892	0.278	
	Large	11 (84.6)	2.4801	0.015	

Abbreviations: CI, confidence interval; NGO, non-governmental organization; χ^2 , chi-square Goodness of Fit Test.

TABLE 7 Descriptive statistics of practice level questions.

Survey measures	Question and response (frequency, %)
Practice	Q1. Have you ever vaccinated your goats against PPR?
	Yes: 53 (40.76%)
	No: 77 (59.23%)
	Q2. How frequently do you conduct health check on your goats?
	Half yearly: 8 (6.15%)
	Yearly: 7 (5.38%)
	Never: 115 (88.46%)
	Q3. Do you isolate new goats before introducing them to your herds?
	Yes: 39 (30%)
	No: 91 (70%)
	Q4. Have you ever participated in PPR awareness campaigns or training session?
	Yes: 47 (36.15%)
	No: 83 (63.84%)
	Q5. What steps do you take if a goat shows signs of PPR infection?
	Visit to veterinarian: 12 (9.24%)
	Visit livestock office: 35 (26.92%)
	Quack: 83 (63.84%)
	Q6. What bio-security practices do you follow to prevent PPR introduction into your farms?
	Good: 24 (18.47%)
	Moderate: 67 (51.53%)
	Bad: 39 (30.00%)

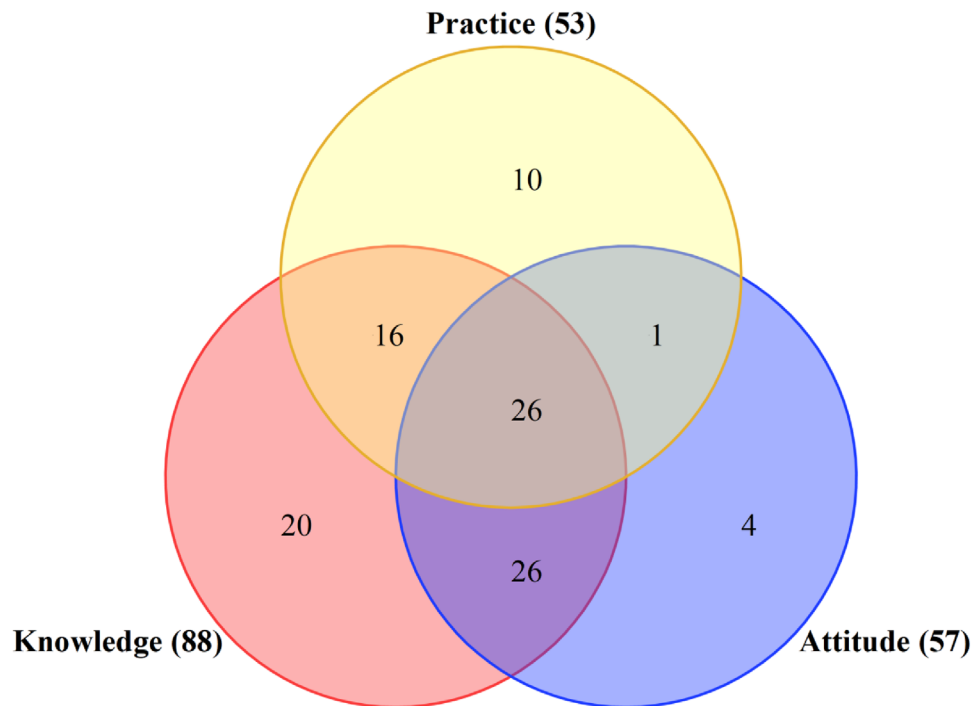


FIGURE 3 Venn diagram showing the knowledge, attitude and practice level among then participants.

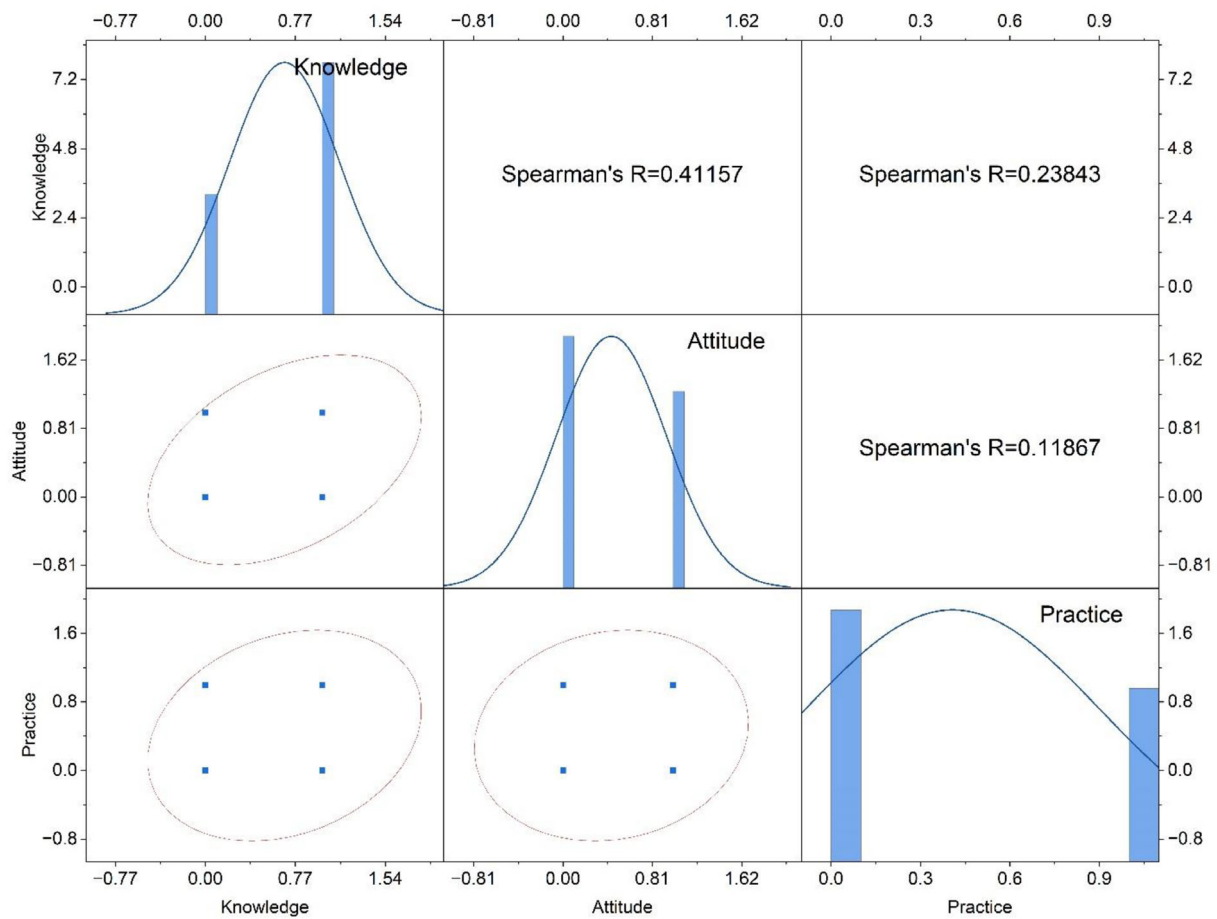


FIGURE 4 Scatter plot correlation (Spearman's correlation) matrix with histogram showing the correlation matrix among the knowledge, attitude and practice level.

eradication by 2030, ensuring the sustainability of livestock health and rural livelihoods in Bangladesh.

AUTHOR CONTRIBUTIONS

Sumaya Shargin Khan and Hemayet Hossain (contributed equally as a first author): Conceptualization; data curation; investigation; formal analysis; software; validation; visualization; writing—original draft; writing—review and editing. **Sohag Talukder**: Writing – review and editing. **Md. Saif Uddin**: Investigation; resources; supervision; writing – review and editing. **Md. Answer Uddin**: Resources; software; supervision. **Md. Saiful Siddiqui**: Conceptualization; formal analysis; funding acquisition; investigation; methodology; project administration; resources; software; supervision; validation; visualization; writing – original draft; writing – review and editing

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ETHICS STATEMENT

Ethical considerations were paramount throughout the KAP survey. Participants provided informed consent, ensuring they understood the study's purpose and their rights. Confidentiality measures were strictly implemented to protect participants' privacy, and efforts were made to minimize any potential harm or discomfort. Cultural sensitivity was maintained throughout, and the study aimed to benefit the community by advancing knowledge and informing future interventions.

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DATA AVAILABILITY STATEMENT

Data are available on request from the corresponding author.

ORCID

Sumaya Shargin Khan  <https://orcid.org/0000-0001-9390-4401>

Hemayet Hossain  <https://orcid.org/0000-0001-9785-2549>

Sohag Talukder  <https://orcid.org/0000-0002-4283-4703>

Md. Saiful Islam Siddiqui  <https://orcid.org/0000-0003-4995-1782>

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