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Original Research Article

Educational association with zoonotic related knowledge and practices of livestock farmers in selective districts of Nepal

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Abstract

This study aims to assess the educational association with knowledge and preventive practices of livestock farmers toward the common zoonoses. A descriptive cross- sectional quantitative research design was followed in the study. The total sample size was 380 livestock farmers from randomly selected three districts of Nepal. Systematic sampling technique was applied for data collection. The data were calculated using descriptive statistics. Univariate, bivariate, and multivariate analyses were performed. The majority of the respondents (52.4%) had basic level education. Similarly, more than two-thirds (67.6%) adopted agro-farming and less than one in ten (7.9%) had livestock as a major occupation in their households. In this study bird flu (95.8%) and rabies (90.7%) are highly known zoonoses and swine flu is average (54.2%) in terms of respondents' knowledge. The finding shows that a large number of respondents with higher education had good knowledge about zoonoses and followed better zoonoses preventive practices. Among the higher educated respondents; practice to avoid sick animal consumption was 86.7 percent, practice to children avoiding livestock contact was 45.5 percent, pregnant women avoiding livestock exposure was 49 percent and pre-exposure vaccination practices was 55.8 percent which showed significant statistical association with their level of education. However, a significant number of respondents with higher education still were unaware about many common zoonoses and poor preventive practices. Therefore; education should be accessible in every community whereas; health education with specific zoonoses in the school curriculum and zoonoses related training for livestock farmers should be warranted.

Keywords: education, educational impact, knowledge, livestock farmers, practices, zoonoses

Introduction

It is projected that more than half of the infectious diseases in human comes from animal sources and is a major public health concern (Taylor et al., 2001). Due to the multiple challenges like environmental pollution, global warming, and the decline of the natural habitation of wildlife caused by de-forestation, nowadays humans have experienced several emerging and re-emerging zoonoses globally. There are several zoonoses in different forms:

epidemics or even pandemics nature such as rabies, highly pathogenic avian influenza (H5N1), influenza A (H1N1), severe acute respiratory syndrome (SARS), Ebola, etc. Contemporary studies have revealed that nearly 20 percent of all human morbidity and mortality particularly in developing countries are strongly associated with endemic zoonoses (Adam, 2021). Zoonoses is an infectious disease that jumps from animals to human (WHO, 2020). People who are close to animals due to various events (i.e., livestock-related occupation, veterinarians, zookeepers, game hunting, and wildlife tourism) are more vulnerable to zoonoses.

The occupational exposure to livestock, farmers especially in poor and developing countries face vulnerabilities to zoonoses. From the perspective of zoonoses, we need to disseminate to livestock farmers that livestock may also be responsible for many lethal pathogens as an intermediate or amplifier host in which several pathogens can evolve and spread to humans (Adam, 2021). Livestock farming plays a significant role not only in livelihood but also contributes to hunger and poverty eradication. But in order to make the occupation sustainable and safe, we need to make livestock farmers more knowledgeable and safer practitioners towards the zoonoses. Department of Health Services mentions that about 60 zoonoses have been identified in Nepal and taeniasis /cysticercosis, leptospirosis, neurocysticercosis, hydatidurias, brucellosis; toxoplasmosis and avian influenza are the priorities and endemic potential zoonoses (DoHS, 2017) with impact on huge human and economic losses. So, as health educators, we need to educate people who are always exposed to livestock without any safety and may not have an idea that livestock may be responsible for the transmission of zoonosis and some might play the amplifying host for many lethal pathogens.

Living in an agrarian country, two-thirds of the population (66%) in Nepal involve in the farming occupation (Adhikari, 2015). The agriculture sector in Nepal contributes significantly to the backbone of the national economy. According to an economic survey published by the ministry of finance, it is estimated that out of the total Gross Domestic Production (GDP), fifth (20.2%) contribution is covered by agriculture sectors (Ministry of Finance, 2021). However, the agriculture sector has been neglected by nation and run traditionally. Many developed countries have controlled or eliminated many lethal pathogens but, in developing countries, people are dying of even vaccine-preventable diseases. In the field of livestock farming in Nepal, farmers are facing vulnerabilities to zoonoses. Some studies shows that zoonoses are highly prevalent in Nepal. Annually about 100 -150 people die because of rabies and dogs are the main source of human rabies contributing to around ninety percent of all rabies transmission (Pant et al., 2013). Brucellosis is a public health problem in Nepal with a significant (5.60 to 9.42 % in males and 2.90 to 60 % in females) prevalence rate (Acharya et al., 2016). Also, bird flu is very common in Nepal. It was detected in the Kavre district in March 2018 with one human fatality for the first time (Shrestha, 2019). Swine flu (H1N1) is another viral zoonotic disease that is endemic in Nepal (Adhikari et al., 2011), are the evidences of zoonoses prevalence in Nepal. Therefore, to prevent and control the zoonoses, we need to know farmers' status on knowledge and preventive practices towards zoonoses by conducting such types of study and interventional programs by applying the One Health approach.

Education is a prime source of knowledge for positive change. However, a significant number (34.1%) of the population in Nepal are still illiterate (Central Bureau of Statistics, 2012b) and people who have no or low education are starting farming as an occupation which makes them more vulnerable to zoonoses. Globalization, industrialization, and commercialization paradigm have been shifting in farming communities (Bagale & Adhikari, 2019). In the context of Nepal, many traditional livestock farmers are shifting to commercial farming, which might contribute to the elimination of hunger and poverty. But in the perspective of zoonoses, we need to raise questions: are the livestock farmers knowledgeable about zoonoses and their consequences, or are they practicing safety techniques during close exposure to their livestock? What is the impact of their existing educational status on their knowledge and preventive practices towards zoonoses, are some of the research issues in farming sectors of Nepal. Researchers in the study aims to determine those realities. Therefore, this study might contribute immensely in the field of livestock farming in Nepal.

Methods and Materials

This study followed a cross-sectional quantitative research design being descriptive in nature. Face to face survey interview technique was employed for data collection. Respondents were selected by systematic random sampling technique from randomly selected three districts namely; Manang, Tanahun, and Nawalpur districts of Gandaki province in Nepal.

Population and Sample Size

The unit of analysis in the study was the household (HH). Therefore, the head of the household (HHH) or family members who were actively involved in livestock caring roles (including poultry farming and buffalo raising) were the populations that were surveyed. Based on the national population and housing census 2011, the total number of households (livestock farmers) including in all study districts was 2835 (CBS, 2012). The probability proportional to size (PPS) sampling technique was used to estimate the sample size by district. Sample size was calculated using the formula suggested by Solvin (Susanti et al., 2019) and the total sample size was added 10 percent for the non-response rate was 390. Among them 380 respondents were interviewed which was selected by systematic random sampling technique in the study.

Data Collection Tools, Technique, and Analysis Procedure

Researchers spent almost 74 days including all study districts for data collection and a total of 380 respondents were taken the survey interview with face-to-face techniques in their households. In the preliminary phase of the data collection procedure, we established a good rapport with the participants and then explained the research objectives. Standardized tools (interview schedule and observation checklist) which was designed after being reviewed by and discussed with supervisors and expert’s committees comprising veterinarians, public health experts, medical officers, experts in health education and statistician as a Delphi technique (Linstone & Turoff, 2002) and pre-tested, were used for data collection. There are four main parts of the questionnaire (i) socio-demographic status of the respondents (ii) knowledge related to zoonoses (iii) preventive practice of zoonoses and (iv) perception measuring questionnaire. However, based on research objective we have excluded perception related data in the article. Collected data were analysed under descriptive statistics including bivariate and multivariate analysis according to the nature of the data.

Ethical Considerations

The study proposal was approved by the research committee board of the graduate school of education, Tribhuvan University, Nepal. During the data collection, the ethical standard was maintained as per Nepal health research council (NHRC) guidelines (NHRC, 2011). Verbal consent was taken before the interview and was requested to participate voluntarily. All data were kept confidential with anonymity. Moreover, we also followed the ethical guidelines made by the American Psychological Association (APA, 2020) throughout the research process.

Results

As shown in Table 1, among the respondents, 8.4% were from Manang, 46.3% were from Tanahun, and 45.2% were covered by Nawalpur district as probability proportional to size (PPS) sampling technique.

Table 1

Socio-demographic Characteristics of the Respondents

Variables	Attributes	Frequency	Percent
District	Manang	32	8.4
	Tanahun	176	46.3
	Nawalpur	172	45.2
Gender	Female	174	45.8
	Male	206	54.2
Age group	20 -39	227	59.7
	40 -59	128	33.7
	60 and above	25	6.6
Main occupation of household	Livestock/ Poultry	30	7.9
	Agro farming	257	67.6
	Government service	33	8.7
	Foreign employee	29	7.6
	Trade	27	7.1
	Other	4	1.1
Average monthly income from livestock	Less than 15,000	297	78.2
	15,000 to 30,000	72	18.9
	Above 30,000	11	2.9
Aim of livestock farming	Household consuming	328	86.3
	Commercial farming	52	13.7
Educational status of respondents	Illiterate	16	4.2
	Up to basic level	199	52.4
	Secondary and above	165	43.4
Training related to farming	Yes (short course)	11	2.9
	No	369	97.1
Type of livestock farming	Single	31	8.2
	Mixed farming	349	91.8
Keeping livestock in the household^{+}	Cow	107	28.2
	Buffalo	200	52.6
	Goat/sheep	260	68.4
	Pig	26	7.1
	Poultry	340	89.5
	Yak/Chauri	7	1.8
Heard of zoonoses^{+}	Bird flu	364	95.8
	Rabies	345	90.7
	Swine flu	206	54.2
	Bovine TB	12	3.2
	Neurocysticercosis	10	2.6
	Brucellosis	6	1.6

Note. $^{+}$Percentage exceeds 100 due to multiple responses

The majority (54.2%) of the respondents in the study was male, nearly 3 in 5 (59.7%) were between 20 to 39 years and the median age of the respondents was 35 years. More than two-thirds (68%) of respondents adopted agro-farming and 7.9 percent were dependent on livestock farming as the main occupation in their households. More than half (52.0%) had basic level education, and very nominal (3.0%) livestock farmers got training related to livestock farming. Likewise, almost respondents (91.8%) were keeping mixed types of livestock in their household, where poultry, goat/ sheep, and buffalo are highly keeping livestock (90%, 68%, and 53%) respectively in their household, where the main purpose of that farming was household consumption (86%) and almost (78.2%) respondents earn less than 15000 rupees per month by their livestock and bird flu is the commonly known (95.8%) zoonoses in the study.

Educational Status and Zoonoses related Knowledge

In the perspective of education, farmers were categorized into three levels. Out of 380 respondent's farmers, 16, 199 and 165 were from illiterate, education with up to basic level and secondary and above respectively. In this part researcher excluded those zoonotic diseases which had a very least knowledge on livestock farmers (neurocysticercosis, bovine tuberculosis and brucellosis). So, here data only analyzed the knowledge related to zoonotic rabies, bird flu and swine flu to determine the association with the existing level of education.

Table 2

Association: Educational Status with Knowledge on Zoonotic Rabies

Variables	Category	Total	Knowledge (%)		X^2	P-value
Heard about zoonotic rabies***						
	Educational level		**Yes**	**No**		
	Illiterate	16	68.8	31.2	30.746	0.000
	Up to basic level	199	85.4	14.6		
	Secondary and above	165	99.4	0.6		
Knowledge on symptoms of rabies in dogs/ animals [hydrophobia]						
	Illiterate	11	81.8	18.2	1.417	0.492
	Up to basic level	170	85.9	14.1		
	Secondary and above	164	89.6	10.4		
Knowledge on mode of transmission of rabies						
	Illiterate	11	90.9	9.1	11.220	0.82
	Up to basic level	170	89.4	10.6		
	Secondary and above	164	95.7	4.3		
Knowledge on preventive measures of rabies						
	Illiterate	11	90.9	9.1	10.047	0.123
	Up to basic level	170	95.9	4.1		
	Secondary and above	164	99.4	0.6		
Knowledge on ARV facilities in district level hospital ***						
	Illiterate	11	0.0	100.	39.087	0.000#
	Up to basic level	170	31.2	68.8		
	Secondary and above	164	61.0	39.0		
Knowledge on prognosis of rabies ***						
	Illiterate	11	18.2	81.8	31.753	0.000
	Up to basic level	170	24.7	75.3		
	Secondary and above	164	37.8	62.2		

Note. #Fisher exact test value

To compare the knowledge related to zoonoses with the different educational categories, it was found that higher respondents (99.4%) had heard about zoonotic rabies who had a higher education (secondary and above) than education up to basic level (85.4%) and respondents who had no read and write (68.8%) and data found highly significant between education and heard zoonotic rabies in the study ($\rho < .001$). Multivariate analysis also shows that respondents with higher education were more than 30 times (OR=30.8; 95% CI: 4.1-277) more likely to be aware about zoonotic rabies than those who had education below secondary level (Table 5). Knowledge on symptoms of rabies on animals (dog) found very similar results on respondents in all educational categories. Where higher respondents (89.6%; 85.9%; and 81.8%) were from secondary and above, up to basic level education and illiterate respectively known about hydrophobia is the symptoms of rabies and slightly greater results shows on knowledge on mode of transmission and preventive measures of rabies in all educational categories in the study.

Rabies is a vaccine preventable disease. Government of Nepal is providing anti rabies vaccine (ARV) at Primary Health Centre (PHC) and hospital free of cost. However, only a few respondents in this study had a knowledge on free ARV services. Educationally, respondents who had no read and write had no knowledge about these services, nearly one third (31.2%) in up to basic level education and nearly two thirds (61.0%; $\rho < .001$) who had education secondary and above had a knowledge about free ARV service. Similar results also found in prognosis of rabies in all educational categories (18.2, 24.7 and 37.8 from illiterate, education with up to basic level and secondary and above respectively).

Knowledge related to swine flu (Table 3) was found in higher proportion of respondents (84.2%) with higher education had heard about swine flu than up to basic level (33.2%) and illiterate (6.2%) and shows the association ($\rho < .001$) between education and heard zoonotic swine flu. Data also shows that higher respondents had a knowledge on symptoms of swine flu (78.8% and 77.7%) who had an education up to basic level and secondary and above respectively whereas illiterate respondents had no knowledge about it. Swine flu is a highly contagious zoonosis. Regarding knowledge the mode of transmission, similar results were found to the symptom of swine flu. Where nearly equal (77.3 and 78.4 %) respondents had a knowledge who had an education up to basic level and secondary and above. However, respondents who had no read and write have no knowledge about mode of transmission which shows the vulnerable situation in farming communities and data shows significant association ($\rho < .001$) in the study. However, all respondents (100.0%) who had no any formal education have a knowledge on preventive measure of swine flu. Whereas, 4 in 5 (80.3%) respondents from up to basic level and nearly same (76.3%) with secondary and above education known the preventive methods of swine flu. Multivariate analysis also shows that respondents who have secondary and above education were more than 12 times (OR=11.8;95% CI: 7.1-19.64) more likely to be aware about swine flu than those who had below secondary education (Table 5).

Table 3

Association: Educational Status with Knowledge on Zoonoses Flu

Variables	Category	Total	Knowledge %		X^2	P-value
Heard about zoonotic swine flu***			Yes	No		
	Illiterate	16	6.2	93.8	110.28	0.000
	Up to basic level	199	33.2	66.8		
	Secondary and above	165	84.2	15.8		
Knowledge on symptoms of swine flu						
	Illiterate	1	0.0	100.	8.774	0.187#
	Up to basic level	66	78.8	21.2		
	Secondary and above	139	77.7	22.3		
Knowledge on mode of transmission of swine flu ***						
	Illiterate	1	0.0	100.	102.81	0.000#
	Up to basic level	66	77.3	22.7		
	Secondary and above	139	78.4	21.6		
Knowledge on preventive practices of swine flu [don't touch facial part unnecessarily]						
	Illiterate	1	100.	0.0	0.711	0.701#
	Up to basic level	66	80.3	19.7		
	Secondary and above	139	76.3	23.7		
Heard about zoonotic bird flu						
	Illiterate	16	87.5	12.5	4.359	0.113
	Up to basic level	199	95.0	5.0		
	Secondary and above	165	97.6	2.4		
Knowledge on symptoms of bird flu in poultry [swelling on head, eyelid and joint] *						
	Illiterate	14	64.3	35.7	6.928	0.031
	Up to basic level	189	67.7	32.3		
	Secondary and above	161	54.0	46.0		
Knowledge on mode of transmission of bird flu [contact infected poultry without safety] ***						
	Illiterate	14	21.4	78.6	46.361	0.000
	Up to basic level	189	70.9	29.1		
	Secondary and above	161	90.7	9.3		
Knowledge on preventive practices of bird flu [use PPE] ***						
	Illiterate	14	14.3	85.7	20.827	0.000
	Up to basic level	189	33.3	66.7		
	Secondary and above	161	54.7	45.3		

Note. ***Significant at $\rho < 0.001$, ** = $\rho < 0.01$ * = $\rho < 0.05$ # Fisher exact test value

Similarly, when compared the bird flu related knowledge with the respondents' level of education, it was found that almost all respondents in all educational categories had a good knowledge on bird flu. However, higher number of respondents (97.6%) with higher education had heard about bird flu than education with up to basic level (95.0%) and illiterates (87.5%). Interestingly, symptoms of bird flu on poultry found the higher knowledge (67.7%) on respondents who had an education up to basic level to compare illiterate (64.3%) and education with secondary and above (54.0%) and shows significant association ($\rho < .05$) in the study. Exposure to infected poultry without safety, is one way of bird flu transmission to human.

Knowledge in this indicator found that, higher respondents (90.7%) had a knowledge who had a secondary and above education to compare the respondents had an education up to basic level (70.9%) and had no education (21.4%), and data found statistically significant ($\rho < .001$) with knowledge and education. Likewise, more than half (54.7%) respondents had a knowledge on preventive methods of bird flu, who had secondary and above education to compare basic level education (33.3%) and (14.3) illiterate respondents and data found statistically significant ($\rho < .001$) in the study (Table. 3).

Association: Educational Status and Zoonoses Preventive Practices

Generally, human behavior is interrelated to their home and societal culture where they grow-up and try to follow without any inquiring whenever they are intervened by any interventional plan for positive change. Table 4. shows the association between education and zoonoses preventive practices of livestock farmers in their households.

Table 4

Educational Status and Zoonotic Preventive Practices

Variables	N	%	Regular	%	Occa.	%	Never	%	X2	P-value
			Hand washing practices							
Below secondary	215	56.6	134	62.3	81	37.7			14.87	0.000
Secondary and above	165	43.4	70	42.4	95	57.6				
			Mask wearing practices							
Below secondary	215	56.6	7	3.3	91	42.3	117	54.4	9.27	0.010#
Secondary and above	165	43.4	18	10.9	70	42.4	77	46.7		
			Gloves wearing practices							
Below secondary	215	56.6	3	1.4	46	21.4	166	77.2	11.41	0.002#
Secondary and above	165	43.4	4	2.4	60	36.4	101	61.2		
			Distance home and shed of livestock farmers							
Education	N	%	<15 m	%	>15 m	%	X^2	P-value		
Below secondary	215	56.6	184	85.6	31	14.4	2.49	0.115		
Secondary and above	165	43.4	150	90.9	15	9.1				
			Sick animal consuming practices							
	N	%	Yes	%	No	%	X^2	P- value		
Below secondary	215	56.6	42	19.6	173	80.4	2.56	0.109		
Secondary and above	165	43.4	22	13.3	143	86.7				
			Children exposure to livestock							
Below secondary	215	56.6	164	76.3	51	23.7	19.89	0.000		
Secondary and above	165	43.4	90	54.5	75	45.5				
			Pregnant women exposure to livestock							
Below secondary	215	56.6	164	76.3	51	23.7	26.50	0.000		
Secondary and above	165	43.4	84	50.9	81	49.1				
			Practices of vaccination to livestock							
Below secondary	215	56.6	43	20.0	172	80.0	52.11	<0.000		
Secondary and above	165	43.4	92	55.8	73	44.2				

Note. Occa. = Occasionally, # refers to Fisher's Exact test values

Hand washing is an easy and cost-effective preventive practice. However, comparing the practice with their level of education found that farmers who had an education below than secondary level found highly (62.3%) regular user of soap water than the respondents with secondary and above education (42.4%) which shows significant association (ρ < .001) with education and regular hand washing practices. Multivariate analysis also showed that higher educated respondents were about 11 times (OR=10.9; 95% CI: 6.3-18.7) less likely to be followed regular hand washing practices than the respondents who had a higher level of education (Table 5).

Similarly, mask user and level of education shows that farmers had a secondary and above education were found more regular user (10.9%) than the respondents with below secondary level education (3.3%) and data shows significant association (ρ <.01) and likely similar practices also shows in gloves using practices in the study (ρ < .01). Distancing between home and shed play the significant role to prevent several zoonoses. Higher respondents (14.4%) who had a below secondary level of education were maintaining this standard than who had a secondary and above education (9.1%), and higher respondents (86.7%) with higher education avoided sick animal consumption practices than (80.4%) respondents who had an education below the secondary level.

Children and pregnant women, who live close to livestock are vulnerable to zoonoses because of their unstable immunity. Higher number of respondents (45.5%) with higher education than the respondents who had an education below than secondary (23.7%) were avoiding to exposure their children with livestock (ρ < .001) and similar practices (49.1%) and association (ρ < .001) also shows in households where women during in pregnancy. Multivariate analysis also shows that higher educated respondents were 0.322 times (OR= 0.322; 95% CI: 0.21-0.51) more likely to be avoided as a role of care taker during pregnancy of their family members than the respondents with lower education (Table 5). Data also shows that farmers had a higher education found higher user (55.8%) of pre-exposure vaccination to their livestock than education below than secondary (20.0%). So, vaccination practice by higher educated farmers was statistically significant (ρ < .001) in the study. Multivariate analysis also showed that respondents with higher education were more than 5 times (OR= 5.04; 95% CI: 0.21 -0.51) more likely to be followed vaccination to their livestock as a pre-exposure prophylaxis (PEP) (Table 5).

Educational Effect on Knowledge and Preventive Practices of Zoonoses

Table 5

Educational Status and Knowledge and Preventive Practices on Zoonoses

Variables	Attributes	Model I	Model II AOR (95% CI)
	Education status and ever heard zoonotic rabies		
Education	Below secondary	1.00	1.00
	Secondary and above	1**(4.1-277)	19.6** (2.5-150)
	Constant	5.3a**	6133.0
	Cox & Snell R	0.085	0.123
	Nagelkerke R Square	0.185	0.268
	Educational status and ever heard zoonotic swine flu		
Education	Below secondary	1.00	1.00
	Secondary and above	11.8***(7.1-19.64)	9.08*** (5.17-15.9)
	Constant	0.453***	0.916
	Cox & Snell R	0.258	0.296
	Nagelkerke R Square	0.345	0.395
	Educational status and hand washing practices		
Education	Below secondary	1.00	1.00
	Secondary and above	10.9 (6.3-18.7) ***	7.8 (4.2-14.7) ***
	Constant	0.67**	0.29
	Cox & Snell R	0.227	0.336
	Nagelkerke R Square	0.307	0.456
	Educational status and practices of children exposure to livestock		
Education	Below Secondary	1.00	1.00
	Secondary and above	0.37*** (.241-.579)	0.45** (.27-.76)
	Constant	3.21***	7.77
	Cox & Snell R	0.051	0.118
	Nagelkerke R Square	0.071	0.163
	Educational status and pregnant women exposure to livestock		
Education	Below secondary	1.00	1.00
	Secondary and above	0.322*** (0.21-0.50)	0.41** (0.24 - 0.68)
	Constant	3.22***	10.3***
	Cox & Snell R	0.067	0.145
	Nagelkerke R Square	0.093	0.200
	Educational status and vaccination practices to livestock		
Education	Below secondary	1.00	1.00
	Secondary and above	5.04*** (3.20-7.94)	3.51*** (2.03-6.05)
	Constant	0.250***	0.028***
	Cox & Snell R	0.130	0.278
	Nagelkerke R Square	0.178	0.382

Note: $^{*}\rho < 0.05$, $^{**}\rho < 0.01$, $^{***}\rho < 0.001$// other variables with education also included in the study but not shown in the article (Table)

Discussion

In Nepal, as an agricultural country, a significant number (66%) of population are involved in the farming occupation (Adhikari, 2015), and farmers are often exposed to zoonotic agents in every aspect of their work. Out of a total of 380 respondents, 7.9 percent have adopted livestock farming as a major occupation in which nearly all keep poultry. Majority of them have a goat/ sheep, buffalo, and nearly one third are keeping cows in their household, and pigs, yak/ Chauri are other livestock which are found in the least number at their households, and almost all households keep more than one types of livestock as a co-farming. This is mostly for the purpose of household consumption and almost all follow traditional farming practices.

In this study, most of the respondents heard about avian influenza followed by rabies and swine flu. However, regarding brucellosis, bovine tuberculosis, and neurocysticercosis, they had very least knowledge [3.2, 2.6, and 1.6% respectively], while all studied zoonoses are endemic potential in Nepal (ANSAB, 2015).

Education is widely recognized as a stronger predictor of positive change (Campbell, 2006). To investigate the association between existing education and zoonoses-related knowledge and practices of livestock farmers, we categorized livestock farmers into three categories: illiterate, basic level and education with secondary and above level. Out of the analyzed three zoonotic diseases, higher respondents knew about bird flu, rabies, and swine flu (95.8, 90.7, 54.2%) respectively. In comparing the variables on knowledge and educational status, it was found that higher respondents with a secondary and above education (99.4%) heard about zoonotic rabies than those with others education categories, with a significant association ($\rho < .001$).

Rabies is a vaccine-preventable zoonosis. The government of Nepal provides anti-rabies vaccine (ARV) up to PHC and district-level hospitals free of cost. However, a significant number of respondents were found to be unaware about this. In terms of the knowledge on ARV services, more respondents having higher education (61%) had a knowledge of ARV ($\rho < .001$) than those with other education categories. Rabies is a fatal zoonosis, however, the majority of them did not know its prognosis. While comparing the results with their level of education, it was found that the respondents with secondary and above education had more knowledge (37.8%) about the prognosis of rabies than others ($\rho < .001$). Kanda and others also revealed the similar findings was that education improved practices on rabies prevention and pet care among children in a resource-limited setting in Sri Lanka (Kanda et al., 2015). Results also indicate that the interventional program successfully increased the pupil's awareness of rabies in a short period. In the Philippines, a pilot rabies information and education campaign has been effectively implemented as a part of the school curricula in all elementary schools in a region (Lapiz et al., 2012). Dzikwi and others studied in Nigeria has also showed that it is highly recommended to provide proper education on rabies among children (Dzikwi et al., 2012).

Swine flu is a highly contagious zoonosis. Higher respondents with higher education (84.2%; $p<.001$) knew about swine flu more than those with lower educational categories. Similar results were found in the knowledge of the respondents about mode of transmission (78.4%; $p< .001$). However, knowledge of symptoms and preventive practices were found slightly lower among respondents who had a higher education. This may be influenced by frequently outbreaks of zoonotic swine flu in the community, and other influences such as media champaign and information dissemination by various agencies.

Likewise, the respondents with all levels of education had a good knowledge of zoonotic bird flu with significant associations between zoonotic-related knowledge and existing level of education. It is highly pathogenic on avian but rarely transmitted to a human. Due to the frequent outbreaks of zoonoses, [it is more than 237 times outbreaks and 1966745 poultry were slaughtered from 2009 to 2016/ 2017 in Nepal (Acharya et al., 2020),] the respondents probably had a good knowledge of bird flu. A similar finding was revealed by (Hundal et al., 2016) on goat farmers in Punjab, India. Where 17.6, 31.2, and 42.4 percent of respondents were educated up to the middle, matric, and senior secondary level respectively whereas 8.8 percent of trainees were graduates. Before training, only 2.4% of the farmers belonged to the high-level knowledge category while 76.8 percent of farmers possessed high-level knowledge after training ($\rho < 0.01$) and Ngowi et al. (2008) studied the randomized community-controlled trial study to estimate the effectiveness of health and pig-management education intervention. The study showed that the intervention reduced the incidence rate of porcine cysticercosis caused by taenia solium.

Behaviors and practices might be influenced by peoples' existing knowledge, socio-cultural values, or perception in a particular context. In Nepal, most livestock farmers follow traditional practices, adopting co-farming and contact to livestock without proper safety measure (Bagale & Adhikari, 2019). But, due to the host and reservoir characteristics of several lethal pathogens, caretaker farmers are facing vulnerabilities to zoonoses by their livestock. As an animal caretaker, livestock farmer needs to follow some precaution to prevent zoonoses. Hand washing, mask, gloves, and boots wearing, which are easy and cost-effective materials are also effective ways to prevent several highly contagious zoonoses.

Generally, people with higher education might have a healthy practice against zoonoses. However, we found some contradictory results in the study. Only half (54.0%) of the respondents in this study wash their hands with soap and water regularly after close exposure to their livestock. Comparing such practices with their level of education, it was found that higher respondents who had an education below than secondary level followed regular hand washing practices than higher educated respondents ($p < .001$), which might be effect of mass awareness and campaign programs during COVID -19 pandemic in the country. In contrast, in the study done in Chitwan, Gorkha, and Tanahun districts, a higher number (94.0%) of smallholder farmers were found to have been washing their hands with soap and water after handling the livestock (Kelly et al., 2018). Likewise, a study in suburban area in Bangladesh;100 percent smallholder livestock farmers wash their hands with soap water after interaction with animals (Chowdhury et al., 2018). With regard to both studies, the better results were probably found because of several motivation and educational interventional activities by a research project (Kelly et al., 2018) or well demographic indicator in the study area in Bangladesh (Chowdhury et al., 2018).

Regular masks and gloves wearing during close exposure to livestock were found poor practices (10.9 and 2.4% respectively) in the study, although it was associated with their level of education ($p<.001$) whereas higher respondents with higher education follow these practices. This finding was similar to farmers in Kars Turkey (Çakmur et al., 2015) where nearly equal (6.6%) respondents used masks regularly but 84% of farmers considered it is necessary and 35.8% of farmers have used gloves regularly with 92.1% having a positive attitude. But, only a few (0.8%) cattle farmers in the Tamale, northern region of Ghana used gloves during handling sick cattle (Ziblim et al., 2021).

There were several influencing factors for close exposure to children and pregnant women to their livestock. More than two-thirds of respondents in the study disclose that their children and pregnant women were close to livestock for various purposes. However, nearly half of the respondents with higher education avoided those practices in the study ($\rho < .001$). Chowdhury et al. (2018) revealed similar results (70.0%) in suburban areas of Bangladesh, where children of respondent farmers have close exposure to their animals. Due to unstable immunity, those types of exposure create a vulnerability to the health of mothers, fetuses, or younger children from zoonoses. Not only that, but to prevent zoonoses, we need to maintain a standard distance between human residents and livestock. However, only least (9.1 to14.4%) of respondents maintain this standard, where respondents with lower education highly followed these practices. From the public health point of view, it should be at least a 15-meter distance between home and shed (Park, 2009, p 663).

The meat of sick or recently dead animals consuming practices are influenced by several socioeconomic status of the people [i.e., culture, economy, or education]. However, few of the respondents (16.8%) in the study still followed those practicing in their communities. In contrast, a study in Kars Turkey revealed good knowledge related to sick and dead animals where four out of five respondents (n=121) knew that it should be buried deep but one fifth practiced it (Çakmur et al., 2015). Most of the zoonoses will be controlled by a cost-effective single-dose vaccination. However, due to several obstacles, farmers are facing many losses in the field of livestock farming. In this study, vaccination practices also found poor coverage among the respondents. Only two-thirds of farmers were vaccinated to their livestock as pre-exposure prophylaxis with significant association to the level of education of the respondents ($\rho < .001$). These practices were found higher (78.26%) in suburban areas of Bangladesh (Chowdhury et al., 2018) than in this study and these types of poor practices might be associated with poverty, illiteracy, and several cultural rituals in the study communities of Nepal.

Conclusion

This study tried to assess the association of education level with knowledge and zoonoses preventive practices among livestock farmers. Out of studied six diseases, respondents had a good knowledge on bird flu and rabies, fair knowledge of swine flu and poor knowledge of other zoonoses. Livestock farmers were also found to have higher risk to acquire zoonotic infection due to inadequate preventive practices while handing the animal. Overall, respondents with higher education had good knowledge regarding zoonoses compared to respondents with lower educational status with exceptions on few practices. Better knowledge and practice regarding zoonoses among respondents with lower education compared to higher educated participants might be contributed to awareness programs through mass media, peer groups influences or previous experience about zoonoses. Therefore, our study suggests that health education with specific zoonoses contains in school curriculum, training for livestock farmers and mass awareness programs during zoonotic outbreaks in the communities are needed along with accessible quality general education system.

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