



Research article

Anthrax prevention practice and associated factors among farmers in Farta district, South Gondar, Amhara region, Northwest Ethiopia

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ABSTRACT

Background: Anthrax is a zoonotic disease endemic in Ethiopia. Despite anthrax preventive measures are the key activities to control the disease, several outbreaks have occurred in Ethiopia recently. The objective of the study was therefore to assess the anthrax preventive practice and its associated factors among farmers in Farta district, South Gondar zone, Northwest Ethiopia.**Method:** A community-based cross-sectional study was conducted among farmers in Farta District from June 7 to 21/2020. A multi-stage sampling technique, with systematic random sampling, was used to select 1,338 study participants. Data were collected through a face-to-face interview using a structured questionnaire. The data were cleaned, coded, and entered into the Epi-data v 3.1 and then exported to SPSS v 23 for analysis. In the bi-variable regression analysis, the variables having a p-value of less than 0.2 were entered into a multivariable logistic regression to control the effect of confounding. Those independent variables with P-value less than 0.05 were taken as statistically significant factors associated with anthrax prevention practice.**Results:** The proportion of farmers who had good anthrax prevention practice was 35.8% [95% CI 33%, 38%]. Being female (AOR = 2.96; 95% CI 2.18, 4.02), able to read and write (AOR = 1.48, 95% CI 1.08, 2.03), time spent to arrive at a nearby veterinary clinic (AOR = 1.35; 95%CI 1.01, 1.79), heard about anthrax (AOR = 4.54; 95%CI 2.96, 6.95), and had a favorable attitude towards anthrax preventions (AOR = 3.70; 95%CI 2.77, 4.94) were significantly associated with anthrax prevention practice.**Conclusions:** The practice of anthrax prevention was low. Sex, educational status, time spent to arrive at the nearby veterinary clinic, knowledge about anthrax, and attitude towards anthrax prevention were significantly associated with anthrax prevention practice. Health education to create a favorable attitude and the establishment of veterinary clinics in the nearby locations are recommended to improve anthrax preventive practices in the study area.

1. Introduction

Background: Anthrax is a zoonotic bacterial disease caused by *Bacillus anthracis*, a gram-positive rod-shaped, and capsulated bacillus [1, 2]. It is the most common bacterial disease in sub-Saharan countries [2]. The major sources of naturally acquired human anthrax infection are direct or indirect contact with infected animals or occupational exposure to infected or contaminated animal products like hides or wool, through skin contact, ingestion, and inhalation of spores [3, 4].

Worldwide, 10,000–100,000 human anthrax incidences occur with a substantial number of cases from developing countries including Ethiopia, and it is the second zoonotic disease next to rabies [5]. Anthrax preventive measures are a very important public health tool to control the disease [6], and in Ethiopia, it is one of the immediately reportable diseases in the public health emergency management (PHEM) surveillance system [7].

According to the Ethiopian Ministry of Health and Ministry of Agriculture, 2009–2013 national survey report, a total of 5,197 human

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anthrax cases and 86 deaths were reported [8] and in the Amhara region, a total of 2,602 cases and 18 deaths were reported between 2010 to 2014, [4]. The principal method for the prevention and control of anthrax in animals and its consequence to humans is primarily through the vaccination of livestock against anthrax. The government of Ethiopia is implementing a vaccination program and awareness creation within the communities, but outbreaks still occur in many regions including in the Amhara region [9]. Since information about the anthrax prevention practice is important to design evidence-based intervention, the objective of the study was therefore to assess the level of anthrax preventive practice and associated factors among farmers in the Farta District of Amhara region, Ethiopia.

2. Methods

Study area and setting: The study was conducted in the Farta district of Amhara regional state, located 680 km from Addis Ababa. The district has a longitude of 38° E and a latitude of 11°40' N with an elevation of 2,000 to 2,500 m above sea level. The district has 33 kebeles (smallest administrative unit), of which one kebele is Urban. Based on projections from the 2007 Ethiopian national census, the 2018/19 total population of the district was estimated to be 204, 853 of which 102,426 were males, and 28,474 were under-five children [10]. In the district, there are 7 health centers, 35 health posts, 3 private clinics, 15 veterinary clinics [11]. The district livestock population is estimated to be 125,961 cattle, 83,390 sheep, 36,804 goats, 45,687 equines and 82,939 poultry. In most households, humans, and animals live in the same house. Based on the retrospective record review in the five years (2013–2017), a total of 2, 595 human anthrax cases and 24 deaths were documented in Amhara region [12]. According to the Amhara public health institute 2019 report, a total of 782 and 59 human anthrax cases were reported in Amhara region and in South Gondar zone respectively [13]. The overall attack rate of anthrax in the Farta district was 2.5 per 1000 animals [14]. Regarding the consumption of animal products, there is a culture of raw meat and milk consumption, and the use of hides for different purposes. There is also the practice consumption of the meat of animals that died from the unknown case [15].

2.1. Study design

A community-based cross-sectional study was conducted from June, 7 to 21, 2020 among farmers in Farta District. South Gondar, Amhara region, Northwest Ethiopia.

2.2. Source and study population

The source population of this study was represented by farmers who live in the Farta District, while the study populations were those farmers living in the randomly selected kebeles of the district.

2.3. Sample size determination and sampling techniques

The sample size was computed using Epi info version 7.1, statistical software for cross-sectional studies, considering the following assumptions; 95% Confidence Level, power 80%, a ratio of 1:1, and taking the proportion of Anthrax preventive practice in a non-exposed group of 20.6% and an AOR of 2 [16], a design effect of 2 and adding 10% non-response rate, the final sample size was 1338. A multi-stage sampling technique was used to select study participants. In the first stage, 10 kebeles from the total 32 rural kebele were selected randomly, and in the second stage, 48 villages from 160 villages of the total selected kebeles were included randomly. After the sample size was proportionately allocated to the selected villages then, the study participants from each village were selected using a systematic random sampling technique taking the interval of 10.

2.4. Data collection tools and techniques

The data were collected through a face-to-face interview using a structured questionnaire after obtaining verbal consent. The questionnaire comprised variables including socio-demographic, knowledge, attitude, veterinary clinic service use, and access, and previous history of the disease. The questionnaire was first prepared in English and translated into Amharic (the local language) and then, translated back to English to ensure internal consistency. Ten data collectors who completed 12th grade and two Bachelor's Degree holders as supervisors were recruited and trained for one day. All the data collectors, the supervisors, and the principal investigators had a meeting to address if any difficulties in the data collection process. A second visit was organized whenever a targeted farmer's house was found empty and was considered as non-respondent if the targeted household head was absent in the second visit.

2.5. Operational definitions

Farmers: In this study farmers are those who engage in plowing, livestock, or both.

Knowledgeable: Farmers who answered more than or equal to 50% of the thirteen knowledge assessment questions were considered as knowledgeable on anthrax prevention. Otherwise considered as non-knowledgeable [17].

Attitude: Farmers who answered more than or equal to 50% of the seven attitude assessment questions were considered as having a favorable attitude towards anthrax prevention. Otherwise considered as having an unfavorable attitude [17].

Anthrax preventive practice: Farmers who answered more than or equal to 50% of the ten practice assessment questions were considered as

Table 1. Sociodemographic characteristics of Respondents in Farta District, South Gondar zone, Northwest Ethiopia, June 7–21, 2020 (n = 1295).

Variables	Category	Frequency	Percent	
Sex	Female	384	29.7	
	Male	911	70.3	
Age (in years)	18–30 years	257	19.8	
	31–41 years	405	31.3	
	≥42 years	633	48.9	
Education status	Unable to read and write	475	36.7	
	Able to read and write only	560	43.2	
	Primary	197	15.2	
	Secondary	38	2.9	
	Preparatory	9	0.7	
	College and above	16	1.2	
Marital status	Single	93	7.2	
	Married	1090	84.2	
	Divorced	57	4.4	
	Widowed	40	3.1	
	Separated	15	1.2	
Religion	Orthodox	1277	98.6	
	Muslim	18	1.4	
Type of animals (n = 4078)	Cattle	1186	29.1	
	Goat	137	3.4	
	Sheep	849	20.8	
	Donkey	357	8.7	
	Horse	463	11.4	
	Cat	533	13.1	
	Dog	553	13.5	
	Family size	≤4 members	734	56.7
		>4 members	561	43.3

having a good practice of anthrax prevention. Otherwise were considered as having a poor anthrax prevention practice [17].

2.6. Data quality assurance

To ensure the quality, a pre-test was carried out in 5% of the sample in the neighboring kebele outside of the study district to check the clarity, sequence, and options for skipping patterns, and one-day training was provided to data collectors and supervisors on the objective, importance of the study, the confidentiality of information, respondent's rights, and techniques of the interview. The whole data collection procedures were closely supervised by field supervisors to ensure the completeness and reliability of the gathered information throughout the data collection process.

2.7. Data processing and analysis

Data were cleaned, coded, and entered into Epi-data version 3.1 and exported to SPSS version 23 for analysis. Missing data were checked by observing frequency results. Descriptive statistics and binary logistic regression were used and the findings were presented using text, figures, and tables. Bi-variable binary logistic regression was carried out to identify candidate variables at p-value <0.2 and were entered into the final multivariable binary logistic regression model to control the effect of confounding. Finally, independent variables with p-values less than 0.05 were declared as statistically significant. An adjusted odds ratio with 95% confidence intervals was used to assess the strength of associations. The goodness of fit model was checked by the Hosmer Lemeshow test and a p-value greater than 0.05 was considered as a good model fit.

2.8. Ethics approval

Ethical clearance was obtained from the Bahir Dar University, College of Medicine and Health Sciences. The letter of ethical clearance was submitted to the Farta district administration and a permission letter was obtained from the district administrator before preceding data collection. Verbal informed consent was obtained from all study participants after explaining the purpose and importance of the study. All farmers' household heads were assured that the data will not have any negative consequences on many aspects of their life. Confidentiality was kept by not exposing or sharing the information gathered from the respondents at all levels of the study. Participants who are not willing to participate and want to withdraw at any step of the interview in the study were informed to do so without any restriction.

3. Results

3.1. Socio-demographic characteristics of the respondents

From the 1,338 study participants, 1,295 study subjects (96.8%) were included in the analysis. Of the total respondents, 911 (70.3%) were males. Nearly half (48.9%) of the respondents lay in the age group of ≥ 42 years, and 475 (36.7%) were unable to read and write. One thousand ninety (84.2%) of the study participants were married (Table 1).

3.2. Veterinary clinic service use and access of the respondents

The majority, 1,153 (89%) of the study participants had a nearby veterinary clinic. But, 32 (2.8) of the respondents said they had no veterinarian in the nearby clinic. About 712 (61.8%) of the respondents got to the clinic within 30 min of walk (Table 2).

Table 2. Veterinary clinic service use and access of respondents in Farta District, South Gondar zone, Northwest Ethiopia, June 7–21, 2020 (n = 1295).

Variables	Category	Frequency	Percent
Availability of a nearby veterinary clinic	Yes	1153	89.0
	No	142	11.0
Veterinarians in the clinic	Yes	1121	97.2
	No	32	2.8
Time taken to arrive the nearby veterinary clinic	≤ 30 min	712	61.8
	> 30 min	441	38.2
You got a vaccination for your animal this year	Yes	553	42.7
	No	742	57.3
You got treatment when your animal ill	Yes	1071	82.7
	No	224	17.3
You got all the drugs prescribed in the clinic	Yes	908	70.1
	No	163	12.6

3.3. Previous history of anthrax diseases-related characteristics of the respondents

As indicated in Table 3 below, the response for some of the variables was more than the sample size and much fewer than the sample size for some of the variables. This is due to the fact that for some of the variables such as a source of information, the respondents have heard from different sources while in the case of the variable such as what actions

Table 3. Previous history of Anthrax disease assessing characteristics of respondents in Farta District, South Gondar zone, Northwest Ethiopia, June 2020 (n = 1295).

Variables	Category	Frequency	Percent
Ever heard about Anthrax	Yes	920	71.0
	No	375	29.0
Source of information (n = 1686)	Veterinarians	631	37.4
	Health extension workers	305	18.1
	Kebele leaders	342	20.3
	Religious leaders	107	6.3
	Radio	92	5.5
	Neighbors	209	12.4
Types of information you got about (n = 2446)	cause of Anthrax	273	11.2
	mode of transmission	433	17.7
	symptoms of animal Anthrax	477	19.5
	Anthrax vaccination	407	16.6
	symptoms of human Anthrax	328	13.4
	actions to be taken when the animals died suddenly	528	21.6
	Does Your animal get ill from Anthrax this year?	Yes	70
No		850	92.4
What actions were taken when your animal gets ill from Anthrax?	Took to clinic	38	54.3
	Slaughtered	3	4.3
	Keeping to death	29	41.4
If you took the animals to the clinic, did they get treatment?	Yes	36	94.7
	No	2	5.3
The treated animals cured?	Yes	14	38.9
	No	22	61.1
If you kept the animals till death, what action you took after died?	Buried	17	65.5
	Left for wild animals	12	34.5
Does your family member ever attack by anthrax	Yes	27	2.1
	No	1268	97.9
Did ill family member get the treatment?	Yes	15	55.6
	No	12	44.4

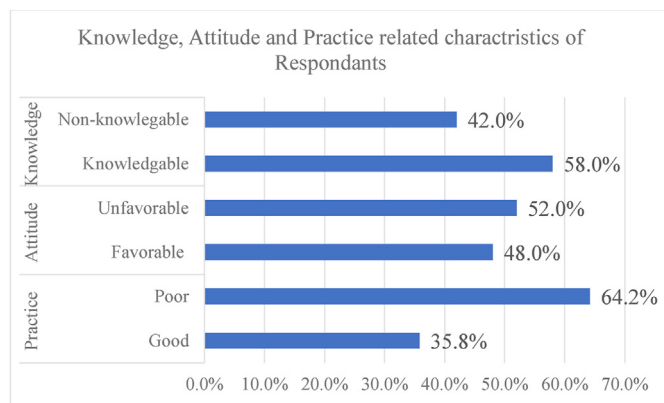


Figure 1. Knowledge, Attitude, and Practice related characteristics of Respondents in Farta District, South Gondar zone, Northwest Ethiopia, June 7–21, 2020 (n = 1,295).

were taken when your animal gets ill from anthrax, the number of respondents was much fewer than the sample size. Seventy-one percent of the respondents had heard about anthrax and 631 (37.4%) of them heard from veterinarians. About 22% of the respondents had information about the actions to be taken when the animals died suddenly. Regarding the animal morbidity, 70 (7.6%) of the respondents had their animals ill this year, and of these 38 (54.3%) of the respondents took the ill animals to veterinary clinics, while 3 (4.3%) of the respondents slaughtered the ill animals (Table 3).

3.4. Knowledge, attitude, and practices related characteristics of the respondents

Knowledge was assessed using thirteen knowledge questions, and more than half 751 (58%) of the study participants had adequate knowledge about the anthrax preventive practice. Regarding respondents' attitudes on anthrax prevention, the composite score of the respondents having a favorable attitude was 48%, and also, 35.8% had good anthrax preventive practice (Figure 1).

3.5. Factors associated with anthrax preventive practices

In the bi-variable binary logistic regression analysis; sex, educational status, age, marital status, time to arrive at a nearby veterinary clinic, heard about anthrax, knowledge, and attitude status were factors associated with anthrax preventive practices at p-value <0.2. While in the multivariable binary logistic regression analysis, sex, educational status, time spent to arrive at a nearby veterinary clinic, hearing about anthrax, and attitude was found to be significantly associated with anthrax preventive practices at p-value <0.05.

Accordingly, for those female participants, the odds of appropriate anthrax preventive practices were about three times higher compared with male participants (AOR: 2.96; 95% CI: 2.18, 4.02; p-value = 0.001). Similarly, for those participants who were able to read and write, the odds of appropriate anthrax preventive practices were about 1.5 times higher compared with those who were unable to read and write (AOR:1.48, 95% CI:1.08, 2.03; p-value = 0.014).

The odds of appropriate anthrax preventive practices for those who spent ≤30 min to arrive at a nearby veterinary clinic were about 1.4 times higher when compared to those who spent >30 min (AOR: 1.35; 95% CI:1.01, 1.79; p-value = 0.039). The odds of anthrax preventive practices of those participants who previously heard about anthrax were about 4.5 times higher when compared to those who didn't hear about anthrax (AOR:4.54; 95% CI:2.96, 6.95; p-value = 0.0001). Moreover, the odds of appropriate anthrax preventive practices of those who had a favorable attitude were 3.7 times higher compared with those who had an unfavorable attitude (AOR: 3.70; 95% CI: 2.77, 4.94; p-value = 0.0001) (Table 4).

4. Discussion

Anthrax prevention practices of farmers in the current study were 35.8% [95% CI: 33%, 38%]. This finding was higher than a study done in Sekota Zuria District reporting that only one-fourth (25.4%) of study participants were practicing in anthrax prevention activities [16].

However, it was lower than studies done in Zambia, 62.2% [6], Zimbabwe, 86% [18], and in Turkey, 51.9% [19]. The possible explanation for this discrepancy might be because rural communities have frequent contact with animals as they represent the main source of

Table 4. Multivariable binary logistic regression analysis for Factors associated with Anthrax preventive practices among farmers in Farta District, Northwest Ethiopia, 2020 (n = 1295).

Variables	Category	Anthrax preventive practice		COR (95%CI)	AOR (95%CI)
		Good	Poor		
Sex	Female	179	205	1.92 (1.51, 2.46)*	2.96 (2.18, 4.02)*
	Male	284	627	1.00	1.00
Educational status	Unable to read and write	141	334	1.00	1.00
	Able to read and write	228	332	1.63 (1.25, 2.11)*	1.48 (1.08, 2.03)*
	Formal education	94	166	1.34 (0.97, 1.85)	1.03 (0.70, 1.51)
Age (in years)	18–30 years	91	166	1.24 (0.91, 1.68)	1.02 (0.66, 1.59)
	31–41 years	178	227	1.77 (1.37, 2.29)*	1.20 (0.87, 1.66)
	≥42 years	194	439	1.00	1.00
Current marital status	Married	409	696	1.48 (1.05, 2.07)*	1.18 (0.76, 1.84)
	Unmarried	54	136	1.00	1.00
Time spent to arrive to a nearby veterinary clinic	≤30 min	293	419	1.44 (1.13, 1.85)*	1.35 (1.01, 1.79)*
	>30 min	144	297	1.00	1.00
Heard about anthrax	Yes	408	512	4.64 (3.39, 6.35)*	4.54 (2.96, 6.95)*
	No	55	320	1.00	1.00
Knowledge status	Adequate	311	440	1.82 (1.44, 2.31)*	0.95 (0.71, 1.26)
	Inadequate	152	392	1.00	1.00
Attitude status	Favorable	334	287	4.92 (3.83, 6.30)*	3.70 (2.77, 4.94)*
	Unfavorable	129	545	1.00	1.00

*P < 0.05, COR: crude odds ratio, AOR: adjusted odds ratio.

income for their daily life such as farming and dairy product. Poor prevention practices might increase the risk of disease transmitted from animal to human [20]. The discrepancy might also be due to the differences in the cultural background, and health information dissemination system among countries.

In addition to assessing the proportion of farmers who practiced anthrax prevention, the study also identified the factors associated with anthrax prevention practices. Being female seems to be associated with better anthrax prevention practices. The odds of having anthrax prevention practice were higher in females compared to the male respondents. This finding was in contradiction to a study conducted in the Sekota Zuria district [16], stating that males practiced more than female respondents. This discrepancy might be explained by saying that in recent years the Ethiopian government provided clear directives to all rural communities, stating that livestock should be kept in or around the house for the whole day so that females have undertaken more responsibilities in taking care of the livestock and therefore they have been more exposed to physical contacts compared to males. But the Ethiopian Health Extension program package focuses on disease prevention and to be practiced at the household level mainly by mothers and therefore mothers might have frequent contact with health extension workers to gain education on the health risk of anthrax and its prevention activities which could help them to significantly practice anthrax preventive measures than males.

Those who were able to read and write only were more likely to prevent anthrax better than farmers who were unable to read and write. This finding was supported by studies conducted in, Sekota Zuria district [16], the central dry zone of Myanmar [21], and Monogr [22]. This might be due to that education influences one's access to information and the ability to understand health messages. Also, education helps to enhance awareness thereby enabling farmers to develop good behaviors to prevent anthrax disease. This indicates that educating people is important in increasing the proportion of farmers with having anthrax disease prevention practices.

The odds of having anthrax preventive practices were strongly performed in those who spent ≤ 30 min to arrive at a nearby veterinary clinic when compared to those who spent > 30 min. The current finding was supported by standard Ethiopian veterinary treatment guidelines [23, 24]. The possible justification for this might be that since the more nearby the veterinary clinic in their vicinity, the more likely they are to have frequent contacts with veterinarians. This result confirms that the chance of getting health education, as well as early communication with veterinary professionals, contributes to enhancing the early treatment of infected animals.

Farmers who previously heard about anthrax were more likely to practice the prevention compared with those who didn't. This study was in agreement with a study conducted in Sekota Zuria District [16], Zambia [6], and in Northern Tanzania [25], reporting that lack of appropriate health information about the health risk of anthrax tends to encourage people to consume raw or undercooked animal products infected with anthrax [24]. This may also indicate the important role of veterinary professionals (animal health workers), health professionals, or another source of information in increasing the knowledge of farmers and raising their awareness towards anthrax and its preventive practices.

This study also confirmed that having a favorable attitude towards the prevention of anthrax was one of the main findings significantly associated with anthrax preventive practices. The odds of anthrax preventive practice were higher among farmers who had favorable attitudes compared to those who had unfavorable attitudes. This finding was supported by studies conducted in Sekota Zuria district, Ethiopia [16], Kenya [26], Tanzania [27], and Kars, Turkey, [19]. This might be related to the fact that human behavior has a significant role in influencing anthrax preventive practices. This behavior is influenced by the attitude which is the driving force for activities to practice, as the better, the farmers have a favorable attitude, the more likely they are practicing anthrax disease prevention.

5. Conclusion

The practice of anthrax prevention was low. Sex, educational status, time spent to arrive at the veterinary clinic, understanding about the health risk of anthrax, and attitude were statistically significant factors for anthrax preventive practices. Educating the community about the health risk of anthrax and the ways of prevention should be given priority by health extension workers, veterinary professionals, and the government at large. Further study using microbiological analysis and assessment of incidence rate needs to be considered.

Declarations

Author contribution statement

Dereje Mesfin, Keadnew Mulat and Amsalu Birara: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Tebkew Shibabaw, Dereje Birhanu and Wubante Yalew: Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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