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Assessment of Knowledge, Attitudes and Practices towards Anthrax among Community Members and Professionals in Dugda Dawa District of West Guji Zone, Southern Ethiopia

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ABSTRACT

Ethiopia is mainly vulnerable to zoonotic diseases (like anthrax) because its economy is primarily dependent on agriculture. There is a paucity of information on knowledge, attitude and practice among this community regarding anthrax. A cross-sectional study was conducted from May 2023 to August 2023 to assess the current knowledge, attitude, and practices towards human and animal anthrax infection among community members and professionals in Dugda Dawa district, southern Ethiopia using a structured questionnaire. A total of 384 (52 vet and medical professionals and 332 livestock owners) were interviewed for this study. About 70.5% of livestock owners heard about the disease anthrax. However, only 19.3% and 47.3% of livestock owners knew anthrax is zoonotic and preventable, respectively. All of professionals knew the disease anthrax and its preventable nature and 71.2% of experts declared that anthrax is zoonotic. The number of livestock owners' who knew one or more right symptoms, transmission ways, or prevention methods of anthrax in animals was 58.1%, 53%, and 47.5%, respectively. From professionals who indicate transmission ways were 73.1%. Only 31.3% respondents were sure that animals' vaccination could help prevent anthrax infection in humans. More than half (55.8%) human and animal health workers claimed that health care workers in their workplace might be exposed to anthrax. Most consumers (90.1%) had a culture of consuming raw or undercooked meat, which is not a good practice. About 80.2% participants believed that eating uninspected beef/mutton with hot pepper sauce locally called "Daxa" could prevent them from getting sick. Almost all animal owners practice a free grazing system (99.7%). Regarding animal vaccination majority (53.9%) of livestock owners didn't know their animals vaccinate against anthrax. This study demonstrates the knowledge, attitude and practice of the participant's regarding anthrax was low. Enhanced public health education and targeted interventions by relevant government agencies is recommended.

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Abbreviations

A/Gada: Abbaa Gada

KAP: Knowledge-Attitude-Practice

OH: One Health

PPE: Personal Protective Equipment

AHP: Animal Health Practitioner

HHP: Human Health Practitioner

OIE: World Organisation for Animal Health

DDWAO: Dugda Dawa Woreda Agricultural Office

Introduction

Ethiopia has the 2nd largest human population in Africa and the largest livestock population on the continent. The country is mainly vulnerable to zoonotic diseases because its economy is primarily dependent on agriculture. About 80% of households directly

contact domestic animals, creating an opportunity for infection and spread of disease. Zoonosis is any disease or condition naturally transmissible from vertebrate animals to humans and vice-versa. Anthrax is a potentially fatal naturally occurring infectious zoonotic disease of warm-blooded animals that primarily affects herbivorous mammals [1-4].

Anthrax is known by several names worldwide, such as carbon, wool sorter's disease, rag pickers' disease, malignant carbuncle, malignant pustule, and Siberian ulcer. Due to its widespread distribution and its potential use as a biological weapon (bioterrorism), anthrax is also believed as a global public health threat. It has a disproportionate impact on the livelihood of livestock owners. Mainly, the public health and livestock product quantity and quality in impoverished rural communities in anthrax-endemic countries are severely affected, resulting in devastating economic loss and loss of livestock product market due to reduced consumer confidence. However, many of those affected countries

have inadequate and unorganized anthrax prevention programs/strategies. In endemic areas, the massive mortality rate of animals can disturb the subsistence livelihood for families and distress the local agricultural sector [5-8].

Anthrax is an endemic/prevalent disease in Ethiopia, which occurs every summer (March and April) and reaches an overwhelming occurrence rate in years with heavy rainfall every year (“anthrax season”) in several farming zones of the country and causing disease both in humans and animals. In Ethiopia, one previous study indicated that anthrax is the most important zoonotic disease, second to rabies, which is dealt with by one health approach. Humans usually contract anthrax by contact with infected meat from wild animals and livestock. In humans, cutaneous anthrax accounts for 95–99% of all recorded cases, while gastrointestinal and inhalation forms of anthrax are less common. Environmental changes, such as deforestation or climatic shifts can alter the distribution of anthrax in the environment, making it more challenging to predict and control outbreaks [1,9- 11].

The occurrence of disease outbreaks in a particular location mostly depends on interacting factors; stated unique characteristics of the bacterium, environmentally related features, animal densities, and human activities. In Ethiopia, raw and undercooked meat consumption and low awareness about anthrax have enhanced the risk of contracting the disease [12].

In Ethiopia, explicitly in the southern part, research is not done to understand the knowledge, attitudes, and practices towards anthrax prevention and control measures among different community members. Moreover, most anthrax prevention and control activities depended on managing an outbreak, including treating sick animals and vaccination of animals at risk. Most of the available publications in the country deal about the clinical and epidemiological aspect of the disease, rather than human behavior. This study assessed current knowledge, attitude, and practices towards human and animal anthrax prevention among the community members (livestock owners, consumers), medical and veterinary health professionals in the Dugda Dawa District of West Guji Zone, Southern Ethiopia. The findings of this study may give pertinent information to the Federal, local governments, and other relevant organizations for the development of strategies and policies that positively impact human behaviors regarding anthrax and other zoonotic disease prevention and control activities [8].

Anthrax continues to persist globally, with an estimated 20,000 to 100,000 incidence cases yearly, and it is highly affecting rural areas in developing nations like Ethiopia. In Ethiopia, human behavior plays a crucial role in the persistence of anthrax due to animals are an essential asset to society. There is a cultural practice of consuming raw (uncooked) meat in every corner of the country. Most community members share the same shelter with animals. Consequently, the death of an animal causes consumption of infected meat and use of animal products, which potentially lead to infections. Moreover, the level of understanding, attitudes, and practices towards human and animal anthrax infection among different community members are not well studied at country bases, particularly in the study area. Hence, this study aims to generate information related to anthrax infection prevention through assessing current knowledge, attitude, and practices among community members and professionals in Dugda Dawa District of West Guji Zone, Southern Ethiopia, through a cross-sectional quantitative study [13].

As well, used to determine the current knowledge, attitudes, and practices towards human and animal anthrax prevention amongst community members (livestock owners, consumers), medical, and veterinary health professionals in Dugda Dawa district of West Zone, Southern Ethiopia. Including, to assess the current knowledge related to anthrax prevention and control activities amongst community members and experts in the study area.

Materials and Methods

Study Area

Dugda Dawa district is one of the districts in West Guji Zone, Southern Ethiopia. It is located at 500 kms, from Addis Ababa and 30 kms from Bule Hora town, the zone capital city. The district is subdivided into 14 kebeles. Its annual rainfall ranges from 300 mm to 600 mm and bimodal rainy season that is two term rainfall seasons. The summer rainfall (long) season, start from March to June and the beginning winter rainfall (short) season, which starts from September and October rainy season. Geographically, the district is located approximately between 5° 23' 56.73" N latitudes and 38° 16' 19.14" E longitudes. The altitude ranges from 1300 up to 1621 masl, and agro-ecologically characterized as kola (Lowland-70%) and dega (Highland-30%). The lowest and highest temperature of the area is 28°C and 32°C respectively. The district has total population of 154,432 of whom 75,385 are men and 79,049 women [14].

Livestock population of the district can be described as 300,623 Cattle, 268,737 Goat, 96,600 Sheep, 87,442 Camel, 42,089 Donkey, 809 Mule, 106,996 poultry [14].

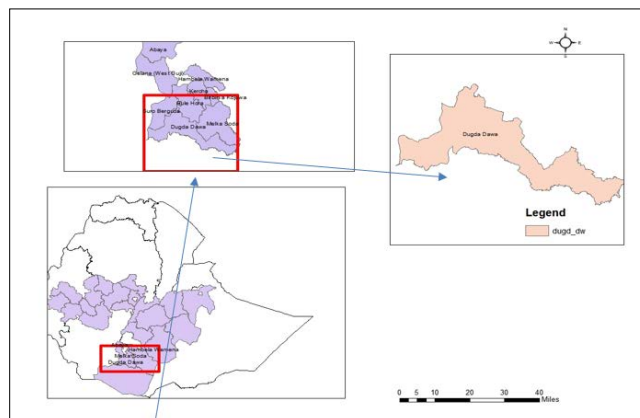


Figure 1: Study Area Map

Operational Definitions

Kebele: The smallest administrative unit of Ethiopia, 4th level administrative division of the regional government, similar to a ward or PA (Peasants Association), a neighborhood or a localized and delimited group.

Zone: It is the 2nd level administrative division of the regional state in Ethiopia, larger than district but smaller than the Regional State.

Community Member: It infers respondents (aged ≥ 18 years) who participated in the questionnaire surveys (which include livestock owners and animal product consumers). It is only used to differentiate attendants who are not medical or veterinary professionals.

Consumer: It refers to a person who uses meat and other animal products as a food source.

Attitudes: This is a positive or negative evaluation of something, like people, objects, or ideas. In this study, the concepts used to refer to the feelings of community members and professionals towards anthrax and how it is perceived as a public and animal health problem.

Medical Professionals: Include all human health workers such as; doctors, clinicians, nurses, and community health workers

Knowledge: In this study, knowledge means awareness of or knowing the disease anthrax, its cause, clinical symptoms, route of transmission, and available prevention mechanisms.

Practices: actual action and or behaviors of community members and professionals undertaking to avoid contracting the human and animal anthrax infection

Veterinary Professional: In the case of this study, it refers to veterinarians and assistant veterinarians who work in governmental institutions supporting animal health.

Source and Study Population

The source population of this study was represented by community members and professionals who live and work in the Dugda Dawa district, while the study populations were those community members and professionals living and working in the randomly selected kebeles of the district.

Study Design and Study Period

A cross-sectional study was conducted from May 22 up to August 30, 2023 to assess the current knowledge, attitude, and practices towards human and animal anthrax infection prevention among community members and professionals.

Sampling Technique and Sample Size Determination

A total of 10 kebeles (PA's) was selected from the 14 kebeles found in the district using the lottery method. The sample size was calculated using the single population proportion formula that is [15]

$$n = \frac{1.96^2(Pexp)(1 - Pexp)}{d^2}$$
$$n = \frac{1.96^2(0.5)(1 - 0.5)}{(0.05)^2}$$
$$n = 384$$

This is by considering the following assumptions: there is no previous study on the knowledge, attitude and anthrax prevention practices in the study area. The sample size was calculated by considering the assumptions of 50% prevalence, 95% confidence interval ($Z=1.96$) and 5% margin of error ($d=0.05$) revealed=384. A systematic random sampling method is used to select 384 participants, which are livestock owners, medical and veterinary professionals from selected kebeles. Professionals who were at work duty and volunteer to fill questioner were selected randomly.

Data Collection

The questionnaire was first translated from English to Afaan Oromo (local language), and administered. Finally, the questionnaire papers were collected and translated in to English.

The questionnaires were focusing on; socio-demographic characteristic of the respondent; knowledge questions; attitude assessing questions; and community practices towards human and animal anthrax infection in the study area.

Data Management and Analysis

At the end of each day of data collection, all questionnaires were handed over and reviewed to ensure that all variables are correctly filled. The collected data was entered into Excel spreadsheet and further export into SPSS for descriptive analysis. Data collect through key informant interviews was analyzed using thematic analysis procedures. The data were summarized using descriptive statistics, including frequency and percentage.

Study Participants Criteria

All consumers, veterinarians, and medical professionals who were chosen to be involved in this study and completed the questionnaire while the data was being collected, as well as owners of livestock. The selection of study participants was contingent upon meeting certain prerequisites, including admittance, consent to fill out the questionnaire, residency in the district for a minimum of six months prior to the study's start, and knowledge of the name or condition of the disease in their immediate vicinity. In addition, participants in this study must be under the age of 18, be unable to provide consent for the questionnaire, and be ignorant of the name or condition of the disease in their community were excluded.

Study Variables

Independent Variables

The sociodemographic traits of the research participants, such as gender, age, education level, occupation, profession, place of residence, religion, and ownership of animals, were utilized as independent factors.

Dependent Variables

Knowledge about Anthrax includes knowing the name of the disease from conventional animal diseases or social media, as well as information about its source, zoonotic appearance, clinical symptoms, mechanism of transmission, and methods for controlling and preventing both human and animal anthrax.

Attitude on Anthrax: determining whether or not anthrax is a community problem, the value of vaccination, remembering the exact moment when an outbreak occurred, the exposure of medical and veterinary professionals to the causative agent, as determined by suspecting or validating diagnostic methods even if a sample is submitted to a regional veterinary laboratory for confirmation, the direct effects of *Bacillus anthracis* spore in animals and humans, and questions pertaining to meat inspection.

Community Practices: The use of personal protective equipment (PPE), lime, or fire while burying the carcass was examined, as well as husbandry methods, meat consumption, and the killing of sick animals for sustenance without first determining the disease types.

Result

Socio-Demographic Factors

Table 1 displayed the sociodemographic attributes of the research participants in the area. 75% (288/384) of the 384 respondents were men, and 305/384% (or around 79.4%) of the respondents were older than thirty. Out of 280 respondents, 72.9 percent lived in rural areas, followed by 20 peri-urban respondents (5.2%), and the remaining 32 respondents (21.9%) lived in urban areas. 151/384, or 39.3%, of them lacked literacy. Among the 300

responders, farmers made up more than three-fourths (78.2%). Protestant made up the majority of responders (52.9%), followed by A/Gada (44.3%), Orthodox (2.6%) and Muslims (0.3%). In terms of occupation, 38 (73.1%) of the participants worked as animal health professionals, whereas 14 (26.9%) were involved in human health.

Table 1: Socio-Demographic Characteristics of the Respondents

Variable	Category	Livestock owners (n=332)		Professionals (n=52)		Cumulative (n=384)	
		Frequency	%	Frequency	%	Frequency	%
Sex	Female	83	21.6	13	3.4	96	25
	Male	249	64.8	39	10.2	288	75
Age	18-29	71	18.5	8	2.1	79	20.6
	≥30	261	67.9	44	11.5	305	79.4
Residence	Rural	280	72.9	-	-	280	72.9
	Peri-urban	20	5.2	-	-	20	5.2
	Urban	32	8.3	52	13.6	84	21.9
Occupation	Farmer	300	78.2	-	-	300	78.2
	Employee	-	-	50	13.0	50	13.0
	Unemployed	4	1.0	-	-	4	1.0
	Self-employed	28	7.3	2	0.5	30	7.8
Religion	Orthodox	7	1.8	3	0.8	10	2.6
	Protestant	154	40.1	49	12.8	203	52.9
	Muslim	1	0.3	-	-	1	0.3
	A/Gada	170	44.3	-	-	170	44.3
Education level	Illiterate	151	39.3	-	-	151	39.3
	Informal education	3	0.8	-	-	3	0.8
	1-8 school	120	31.3	-	-	120	31.3
	9-12 school	44	11.5	-	-	44	11.5
	Diploma	14	3.6	16	4.2	30	7.8
	Degree and above	-	-	36	9.4	36	9.4
Profession	AHP	-	-	38	73.1	38	73.1
	HHP	-	-	14	26.9	14	26.9

Participant’s Knowledge Related to Anthrax Livestock Owners’ Knowledge about Anthrax Disease

Table 2 displays participant responses about their level of awareness of anthrax. The majority of cattle owners, or 70.5% (234/332), were aware of the anthrax disease and knew it locally as “Qooraa.” However, 29.5% (98/332) of the participants were unaware of the illness. The majority of animal owners (80.7%) were unaware that anthrax is a zoonotic disease. Out of the 332 participants, 157 (47.3%) acknowledged that anthrax is a preventable disease, while 175 (52.7%) disagreed.

Table 2: Livestock Owners’ Knowledge (Heard about Anthrax, Zoonosis and Preventability)

Variable	Have you heard about disease called anthrax? (n=332)		Zoonotic nature of anthrax (n=332)		Do you think anthrax is a preventable disease? (n=332)	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
Sex						
Female	70 (21.1)	13 (3.9)	16 (4.8)	67 (20.2)	29 (8.7)	54 (16.3)
Male	164 (49.4)	85 (25.6)	48 (14.5)	201 (60.5)	128 (38.6)	121 (36.4)
Age						
18-29	48 (14.5)	23 (6.9)	11 (3.3)	60 (18.1)	15 (4.5)	56 (16.9)
≥30	186 (56.0)	75 (22.6)	53 (16.0)	208 (62.6)	142 (42.8)	119 (35.8)
Residence						
Rural	196 (59.0)	84 (25.3)	61 (18.5)	219 (65.9)	135 (40.7)	145 (43.7)
Peri-urban	17 (5.1)	3 (0.9)	1 (0.3)	19 (5.7)	17 (5.1)	3 (0.9)
Urban	21 (6.3)	11 (3.3)	2 (0.6)	30 (9.0)	5 (1.5)	27 (8.1)
Occupation						
Farmer	206 (62.1)	94 (28.3)	60 (18.1)	240 (72.3)	157 (47.3)	143 (43.1)
Unemployed	-	4 (1.2)	-	4 (1.2)	-	4 (1.2)
Self-employed	28 (8.4)	-	4 (1.2)	24 (7.2)	-	28 (8.4)
Religion						
Orthodox	4 (1.2)	3 (0.9)	4 (1.2)	3 (0.9)	5 (1.5)	2 (0.6)
Protestant	59 (17.8)	95 (28.6)	24 (7.2)	130 (39.2)	24 (7.2)	130 (39.2)
Muslim	1 (0.3)	-	-	1 (0.3)	-	1 (0.3)
A/Gada	170 (51.2)	-	36 (10.8)	134 (40.4)	128 (38.5)	42 (12.7)
Education level						
Illiterate	58 (17.5)	93 (28.0)	26 (7.8)	125 (37.6)	9 (2.7)	142 (42.8)
Informal	1 (0.3)	2 (0.6)	1 (0.3)	2 (0.6)	1 (0.3)	2 (0.6)
1-8 school	120 (36.1)	-	23 (6.9)	97 (29.3)	92 (27.2)	28 (8.4)
9-12 school	41 (12.4)	3 (0.9)	13 (3.9)	31 (9.4)	41 (12.3)	3 (0.9)
Diploma	14 (4.2)	-	1 (0.3)	13 (3.9)	14 (4.2)	-
Total	234 (70.5)	98 (29.5)	64 (19.3)	268 (80.7)	157(47.3)	175(52.7)

Professionals’ Knowledge about Anthrax Disease

100% of the professionals were aware of the anthrax diseases and how prevented it is. Nonetheless, the majority of experts respondent surveyed (71.2%) stated that humans can contract anthrax from animals. Conversely, Table 3 shows that 28.8% of them thought it had no zoonotic significance

Table 3: Professionals’ Knowledge (Heard about Anthrax, Zoonosis and Preventability)

Variable	Knowledge of anthrax (n=52)		Knowledge of zoonotic nature (n=52)		Do you think anthrax is a preventable disease? (n=52)	
	Yes (n/%)	No (n/%)	Yes (n/%)	No (n/%)	Yes (n/%)	No (n/%)
Sex						
Female	13 (25)	-	8 (15.4)	5 (9.6)	13(25)	-
Male	39 (75)	-	29 (55.8)	10 (19.2)	39 (75)	-
Age						
18-29	8 (15.4)	-	8 (15.4)	-	8 (15.4)	-
≥30	44 (84.6)	-	29 (55.8)	15 (28.8)	44 (84.6)	-
Occupation						
Employee	50 (96.2)	-	35 (67.3)	15 (28.8)	50 (96.2)	-
Self-employed	2 (3.8)	-	2 (3.8)	-	2 (3.8)	-
Profession						

AHP	38 (73.1)	-	23 (44.2)	15 (28.8)	38 (73.1)	-
HHP	14 (26.9)	-	14 (26.9)	-	14 (26.9)	-
Religion						
Orthodox	3 (5.8)	-	3 (5.8)	-	3 (5.8)	-
Protestant	49 (94.2)	-	34 (65.4)	15 (28.8)	49 (94.2)	-
Education level						
Diploma	16 (30.8)	-	8 (15.4)	8 (15.4)	16 (30.8)	-
Degree and above	36 (69.2)	-	29 (55.8)	7 (13.5)	36 (69.2)	-
Total	52 (100)	-	37 (71.2)	15 (28.8)	52 100	-

Participant’s Knowledge Related to Animal Anthrax

Basic questions about the disease, including clinical signs, the mechanism of transmission, and preventative measures against animal anthrax, were used to determine respondents’ level of knowledge. The percentages of livestock owners who were aware of one or more correct symptoms, routes of transmission, or strategies for controlling or preventing animal anthrax were 58.1% (199/332), 53% (176/332), and 47.3% (157/332), respectively. The percentage of respondents who were unaware of the clinical signs, modes of transmission, and methods for controlling or preventing anthrax in animals was 41.9% (133/332), 47% (156/332), and 52.7% (175/332), in that order. From the list of clinical symptoms supplied in the questionnaire for animal owners, which was completed by 141 out of 332 participants, bleeding from natural orifices was the most often selected option. Similarly, when it came to the transmission mode, “By drinking contaminated water” had the highest responses. Among those who chose it, 124 (37.3%) said, “bury all anthrax suspected carcass.” Livestock owners answered most of the questions on a list of anthrax prevention techniques in 45 (13.6%) of the cases. However, 40 individuals (12.0%) thought that traditional medicine might stop animal anthrax.

Veterinarians and other medical professionals identify one or more accurate signs, routes of transmission, and preventative measures for anthrax in animals; these percentages are 52(100%), 38(73.1%), and 52(100%), respectively. The percentage of respondents who were unaware that anthrax may spread through animals was roughly 26.9%. Essential symptoms, modes of transmission, and preventative strategies for anthrax were burning all suspicious animal corpses (69.2%), drinking contaminated water (63.5%), and bleeding from natural orifices (75.0%). Remarkably, 4 (7.7%) of medical experts who deal with both humans and animals feel that traditional or herbal medicine is crucial for preventing anthrax (Table 4).

Table 4: Knowledge of Participants towards Animal Anthrax in Dugda Dawa District

Variable	Community members (n=332)		Profession (n=52)	
	Frequency	%	Frequency	%
Do you know the clinical symptoms of anthrax in animals?				
Yes	193	58.1	52	100
No	139	41.9	-	-
Clinical symptoms of anthrax in animals				
Suddenly death	131	39.5	37	71.2
Bleeding from natural orifices	141	42.5	39	75.0
Unclothed dark red bleed	98	29.5	34	65.4
Incomplete rigor mortis	-	-	17	32.7
Do you know the transmission routes of anthrax in animals?				
Yes	176	53.0	38	73.1
No	156	47.0	14	26.9
Anthrax transmission in animals				
By licking other sick animals	27	8.1	4	7.7
By ingesting blood contaminated grass	95	28.6	24	46.2
Through drinking contaminated water	124	37.3	33	63.5
By licking anthrax dead bones	58	17.5	19	36.5
Via flies	20	6.0	9	17.3

Do you know the prevention measures of anthrax in animals?				
Yes	157	47.3	52	100
No	175	52.7	-	-
Anthrax prevention in animals				
Burn all suspected anthrax animal carcasses	43	13.0	36	69.2
Bury all suspected anthrax carcasses	45	13.6	33	63.5
Vaccinate animals	30	9.0	28	53.8
Using Traditional medicine	40	12.0	4	7.7

Participant’s Knowledge Related to Human Anthrax

Basic knowledge questions about the disease, including clinical signs, the route of transmission, and preventative measures against human anthrax, were used to evaluate the respondents. Of the 322 cattle owners, 70 (21.1%), 9 (2.7%), and 23 (6.9%) were aware of one or more correct symptoms, routes of transmission, or strategies for controlling or preventing anthrax in humans. The percentage of respondents who were unaware of the clinical signs, modes of transmission, and methods of control or prevention for anthrax were 262 (78.9%), 323 (97.3%), and 309 (93.1%), in that order. Of the clinical symptoms listed in the questionnaire for animal owners, skin rash/wounds were the most frequently selected option, and only 26 out of 332 participants responded to it. Similarly, 35 participants (10.5%) chose to burn suspected carcasses of anthrax as their most frequently answered response to the transmission mechanism of “handling hides, wool, or hair of dead animals.” Out of the questions asked by livestock owners on anthrax preventive strategies, 10 (3%) reported the most. However, just 1 (0.3%) of the participants thought that immunization against animal anthrax may prevent the disease.

Veterinarians and other medical professionals make up 23(44.2%), 37(71.2%), and 49(94.2%) of those who can correctly identify one or more anthrax symptoms, modes of transmission, and preventative measures in people. Of the 52 participants, only 11 selected irritabilities as their most common clinical symptom from the list supplied in the professional questionnaire. Comparably, 34 participants (65.4%) chose to consume dead animal meat as the most frequently picked response for the transmission mode, “avoiding skinning anthrax dead cadaver.” Professionals asked a series of questions about ways to avoid human anthrax, of which 43 (82.7%) reported the most (Table 5).

Table 5: Knowledge of Participants Pertaining to their Knowledge towards Human Anthrax in Dugda Dawa District

Variable	Community members (n=332)		Profession (n=52)	
	Frequency	%	Frequency	%
Do you know the clinical symptoms of anthrax in humans?				
Yes	70	21.1	23	44.2
No	262	78.9	29	55.8
Clinical symptoms of anthrax in humans				
Fever and excessive sweating	18	5.4	2	3.8
Skin rash/wounds	26	7.8	6	11.5
Cough	10	3.0	2	3.8
GIT symptoms (diarrhea, vomiting)	18	5.7	6	11.5
Irritability	24	7.2	11	21.2
Do you know the transmission routes of anthrax in humans?				
Yes	9	2.7	37	71.2
No	323	97.3	15	28.8
Anthrax transmission in humans				
While slaughtering and skinning	28	8.4	25	48.1
Handling hides, wool, or hair of dead animals	36	10.8	28	53.8

Consuming dead animal meat	28	8.4	34	65.4
Handling infected carcass or bone	5	1.5	26	50.0
Do you know the prevention measures of anthrax in human?				
Yes	23	6.9	49	94.2
No	309	93.1	3	5.8
Anthrax prevention in humans				
Avoiding contact with anthrax infected animals	5	1.5	36	69.2
Avoiding eating anthrax infected animal products	7	2.1	26	50
Burn anthrax suspected carcasses	10	3.0	39	75
Avoiding skinning anthrax dead cadaver	9	2.7	43	82.7
Animal vaccination	1	0.3	38	73.1

Participants Attitude towards Human and Animal Anthrax

Attitude Towards Human and Animal Anthrax Among Livestock Owners

Only 21 (6.3%) of the 332 animal owners in the study area believed that anthrax could spread to humans, and only 107 (32.2%) had stated that they were certain that it could. When asked about the seriousness of animal and human anthrax in and around their locality, about 74 (22.3%) respondents declared that animal anthrax is a problem in their community, but only 27 (8.1%) reported animal anthrax as a problem. 31.3% of respondents were certain that vaccinations for animals could help prevent anthrax infection in humans. About 44.9% (149) participants vaccinate their animals to protect them from anthrax infection. Remarkably, only two participants answered that humans can be protected from anthrax.

Table 6: Attitude towards Human and Animal Anthrax among Livestock Owners in the Dugda Dawa District

Variable	Livestock owners (n=332)	
	Frequency	%
Does anthrax transmit among humans?		
Yes	21	6.3
No	49	14.8
Do not know		
Does anthrax transmit among animals?		
Yes	107	32.2
No	49	14.8
Do not know		
Do you think that animal anthrax is a problem in your locality?		
Yes	27	8.1
No	182	54.8
Do not know		
Do you think that human anthrax is a problem in your locality?		
Yes	74	22.3
No	134	40.4
Do not know		
Do you think that vaccination of animals can help to prevent anthrax in humans?		
Yes	104	31.3
No	47	14.2
Do not know		
	181	54.5

What provokes you to take your animals for vaccination?		
To protect animals	149	44.9
Because others do so	181	54.5
To protect humans	2	0.6
How frequently animal vaccination against anthrax done in your locality?		
Twice a year	8	2.4
Once a year	175	52.7
Never Vaccinated	78	23.5
Others (More than 2 times, no fixed time)	71	21.4

Attitude towards Anthrax among Vets and Medical Professionals

Every responder said that anthrax in animals is a serious problem in their area, and 96.2% of veterinarians and other medical professionals said that anthrax in humans is a problem in their neighborhood as well. There was an anthrax outbreak in their area, according to every respondent. While 17.3% of participants said that the anthrax outbreak had already happened this year at the time of the interview, the majority of interviewees (55.6%) remembered the outbreak that had occurred prior to this year. However, roughly 26.9% of experts were unable to pinpoint the precise time it was discovered. The majority of respondents (59.6%) to the question of how vaccination protects an animal from anthrax thought that vaccination could strengthen an animal's immunity. Only four out of fifty-two health workers and veterinarians had the experience of handling a patient's wound or skin rashes or a critically ill animal without the proper personal protective equipment (PPE). More than half (55.8%) of human and animal health workers claimed that health care workers in their workplace might be exposed to anthrax. Every responder (52 out of 52) believed that livestock may become directly infected by *Bacillus anthracis* spores found in soil. On the other hand, 69.2% (36/52) held a negative opinion due to their belief that *Bacillus anthracis* spores in soil could directly endanger human health (Table 7).

Table 7: Attitude and Practices towards Anthrax among Vets and Medical Professionals in the Dugda Dawa District

Variable	Profession (n=52)	
	Frequency	%
Do you think that animal anthrax is a problem in your locality?		
Yes	52	100
No	-	-
Do not know	-	-
Do you think that human anthrax is a problem in your locality?		
Yes	50	96.2
No	2	3.8
Do not know	-	-
Have you had an anthrax outbreak in your locality?		
Yes	52	100
No		
Do not know		
When did the anthrax outbreak occur in your locality?		
Do not know	-	-
Within this year	9	17.3
Before this year	19	55.8
Do not remember	24	26.9
How vaccination protects an animal?		
It makes an animal strong	5	9.6
It makes an animal healthy	16	30.8
It enhances an animal immunity	31	59.6
Do you think that medical workers in their workplace could contract anthrax?		

Yes	29	55.8
No	-	-
Do not know	23	44.2
Have you had any experience of touching the blood of a severely sick animal without an adequate PPE?		
Yes	4	7.7
No	48	92.3
Have you had any experience of touching a patient's wound/skin rashes without adequate PPE?		
Yes	4	7.7
No	48	92.3
Do you think that <i>Bacillus anthracis</i> spores in soil pose a direct risk of infection for human beings?		
Yes	36	69.2
No	16	30.8
Do you think that <i>Bacillus anthracis</i> spores in soil do pose a direct risk of infection for livestock?		
Yes	52	100
No	-	-

Attitude and Practices towards Anthrax among Consumer Participants

It is not a good habit for the majority of customers (346, or 90.1%) to eat meat that is raw or undercooked. The majority of respondents stated that they only had meat once a week (44.5%) and once a month (43.8). The following are the sources of meat mentioned by respondents: Only 1 (0.2%) came from unlicensed butcher shops, 59.1% (227/384) from regulated butcher shops, 135/384 (35.6%) from street vendors, and 5.5% (21/384) from farmers. While 84.1% (323/384) of customers believed that the meat had not been examined by veterinarians prior to being released to the public, 93.5% (359/384) of respondents said they did not engage in house slaughter with their neighbors. About 80.2% (308/384) of the participants thought they could avoid becoming sick by consuming uninspected beef or mutton with a spicy pepper sauce known as “Daxa” in the area (Table 8).

Table 8: Attitude and Practices towards Human and Animal Anthrax among Consumers in the Dugda Dawa District, Southern Ethiopia, 2023

Variable	Community members (n=332)		Profession (n=52)		Cumulative	
	Frequency	%	Frequency	%	Frequency	%
Do you consume raw (undercooked) meat?						
Yes	330	99.4	16	30.8	346	90.1
No	2	0.6	36	69.2	38	9.9
Frequency of meat consumption?						
Daily	28	8.4	-	-	28	7.3
Weekly	124	37.3	47	90.4	171	44.5
Monthly	168	50.6	-	-	168	43.8
Only in holydays	11	3.3	5	9.6	16	4.2
Others (3 x /week, 2 x /month)	1	0.3	-	-	1	0.2
Source of meat?						
Authorized Butchers shop	175	52.7	52	100	227	59.1
Street sellers	135	40.7	-	-	135	35.6
Farmers	21	6.3	-	-	21	5.5
Unauthorized butcher	1	0.3	-	-	1	0.2
Do you think that meat has been inspected by vets before being distributed to the public?						
Yes	9	2.7	52	100	61	15.9

No	323	97.3	-	-	323	84.1
Do you practice home slaughter (meat that has not inspected by the vet)?						
Yes	18	5.4	7	13.5	25	6.5
No	314	94.6	45	86.5	359	93.5
Do you think that eating uninspected meat with hot pepper sauce” daxa” can prevent you from getting sick?						
Yes	303	91.3	7	13.5	308	80.2
No	29	8.7	45	86.5	76	19.8

Practices towards Human and Animal Anthrax among Livestock Owners

A 99.7% majority of livestock owners use a free grazing approach. Surprisingly, the majority of respondents (59%) who took part in the interview experienced slaughter and shared the meat with the community when an animal died unexpectedly. Some respondents only use one system. The remaining respondents—25%—practiced calling in veterinarians, 14.6% had experience alerting veterinarians, 10.6% called in butchers, and 4.6% shared a custom of butchering an animal that has passed away from an unusual cause and distributing the flesh among the neighbors. Approximately 3 (0.9%) of the 81 individuals who had buried carcasses used lime during the process. However, when handling the carcass, just 0.6% (2/332) of animal keepers wear personal protective equipment, such as gloves and face masks made of local materials. The majority of cattle owners (53.9%) were unaware that their animals get vaccinated against anthrax. Only cattle (34.9%) received vaccinations. It was surprising to find that the majority of respondents (48.8%) did not vaccinate their animals. Animal owners who choose not to vaccinate their animals against anthrax also cited lack of vaccine (5.4%) and desire to save money (10.8%). Table 9 presents the results.

Table 9: Practices towards Human and Animal Anthrax Among Livestock Owners in the Dugda Dawa District

Variable	Community members (n=332)	
	Frequency	%
Which type of animal husbandry do you practice?		
Free grazing	331	99.7
Zero grazing	1	0.3
Mixed-free-range and zero-grazing	-	-
When your animal dies suddenly, what would you do?		
Threw the carcass into the puddle or jungle		
Bury the carcass		
Slaughter and share the meat with the community		
Call in the butcher		
Call in the veterinarians		
Would you use lime while burying the anthrax suspect carcass?		
Yes	3	0.9
No	329	99.1
Do you use PPE while touching anthrax suspect carcass?		
Yes	2	0.6
No	330	99.4
Were your animals vaccinated against anthrax?		
Yes	116	34.9
No	38	11.4
Don't know	178	53.6
If yes, which animal species were vaccinated?		
Cattle	116	34.9
Goats	-	-

Donkey	-	-
Sheep	-	-
Horse	-	-
Camel	-	-
If no, why your animals not vaccinated?		
To save money by vaccinating only some animals	36	10.8
Not necessarily to vaccinate	162	48.8
Shortage of vaccine	18	5.4
It may damage such particular animal species	1	0.3
No awareness	-	-

Discussion

The present study tried to explore a broad concept in terms of human and animal anthrax's knowledge, attitude, and practices by livestock owners and, veterinary and medical professionals in Dugda Dawa District of Guji Zone, Southern Ethiopia. It opens the door for future findings, research, surveillance, prevention, and control efforts of human and animal anthrax in the study area and throughout the country. The study findings show that current knowledge of human and animal anthrax varies among different categories (livestock owners and professionals) and socio-demographic factors. In this study, 70.5% (65.4-75.6%) of livestock owners heard about anthrax.

The current finding coincides with the results of previous studies reported 71% by in Farta district, South Gondar, Amhara region, Northwest Ethiopia and 71.5% in selected rural communities of Zimbabwe. But this result was lower than the finding in Northern Ethiopia (62%) by and Bangladesh (62.74%) by. However, this finding is much lower than the results who reported 96.3 % in Maragua Kenya, 98.3% in Sekotazuria district northeast Ethiopia, 88% in Zambia and 77% in Sodo Zuriya District of Wolaita Zone, Southern Ethiopia, respectively. This variation may be due to most livestock owners live in rural areas, no access to medias and insufficient veterinary services. Surprisingly, in this study only 19.3% of livestock owners know anthrax was transmitted from animal to human. Transmission through handling hides, wool, or hair of dead animals was mentioned by 10.5% of the respondents, while slaughtering 8.4% and ingestion 8.1%. This finding is lower than the study done in Ethiopia 99% while slaughtering, 90% handling hides, wool, or hair of dead animals, 95% ingestion and Kenya reported 65.2% through ingestion, 21.7% through skinning and study done in Bangladesh 47.16% ingestion. These low levels of knowledge related with transmission routes of disease exposes livestock owners to the disease. This discrepancy is may be due to poor access to media information and poor comprehension and compliance to health education messages [7,16-22]

The finding of this study shows that 47.3% of livestock owner respondents knew anthrax is preventable. This result was in agreement with the previous studies conducted by, who reported 43.4% in Northern Ethiopia and 39.2% in Bangladesh, respectively. However, the present finding was comparably lower than the study of, who reported 81.6% in Maragua Kenya, 67.2% in Sekotazuria district northeast Ethiopia and 65% in Sodo Zuriya District of Wolaita Zone, Southern Ethiopia, respectively. This variation may be due to socio demographic difference and the magnitude of the disease [7,18,19,20,22].

All of professionals (medical and vet), 100% knew the disease

anthrax and its preventable nature. This finding is higher than the report 79% in Northern Ethiopia by, 72.5% in Kellem Wollega by and 88% in Sodo Zuriya District of Wolaita Zone Ethiopia by. However, 71.2% of experts declared that anthrax is transmitted from animals to humans. The current finding was in line with the reports of, who reported knowledge level of 79% in Northern Ethiopia. However, it was lower than the finding of who reported knowledge level 91.3% in Kellem Wollega and 83% in Sodo Zuriya District of Wolaita Zone Ethiopia, respectively. In comparison, professionals had good knowledge towards the zoonotic nature and preventability of anthrax than livestock owners. This variance might be due to in the current study area; both human and animal health professionals had more experience of handling anthrax cases and had better access to information of the disease [18,22,23].

In the current study 58.1% of livestock owners knew the symptoms of anthrax in animals, 43.1%, 40.1% and 30.1% of respondents mentioned bleeding from natural orifices, sudden death and un-clotted dark red blood as clinical symptoms of anthrax, respectively. In other hand, all professionals knew the symptoms of anthrax in animals, 75%, 71.2%, 65.4% and 32.7% of respondents mentioned bleeding from natural orifices, sudden death un-clotted dark red blood and incomplete rigor mortis as clinical symptoms of anthrax, respectively. In the current study 53% of livestock owners knew the transmission of anthrax in animals, 37.3%, 28.6%, 17.5% and 8.1% of respondents mentioned drinking contaminated water, ingesting blood contaminated grass licking anthrax dead bones and licking other sick animals as transmission way of anthrax in animals, respectively. In addition, 73.1% of professionals knew the transmission of anthrax in animals, 63.5%, 46.2%, 36.5% and 7.7% of respondents mentioned drinking contaminated water, ingesting blood contaminated grass licking anthrax dead bones and licking other sick animals as transmission way of anthrax in animals, respectively. In the current study, 13.6%, 13%, 12% and 9% of respondents mentioned burying all suspected anthrax carcasses, burning all suspected anthrax animal carcasses, using traditional medicine and vaccinating animals as prevention methods of anthrax animals, respectively. Regarding to professionals, 69.2%, 63.5%, 53.8% and 9.6% of respondents mentioned burning all suspected anthrax animal carcasses, burying all suspected anthrax carcasses, vaccinating animals and using traditional medicine as prevention methods of anthrax animals, respectively. The difference level of knowledge between livestock owners and professionals may be due to experience of handling anthrax cases and had better access to information of the disease.

In the current study only 21.1% of livestock owners knew the symptoms of anthrax in humans, 7.8%, 7.2%, 5.7%, 5.4% and 3% of respondents mentioned skin rash/wounds, irritability, GIT

symptoms (diarrhea, vomiting), fever and excessive sweating and cough as clinical symptoms of the disease, respectively. In other hand, only 44.2% of professionals knew the symptoms of anthrax in humans, 17.3%, 13.5%, 11.5%, 3.8% and 3.8% of respondents mentioned GIT symptoms (diarrhea, vomiting), irritability, skin rash/wounds, fever and excessive sweating and cough as clinical symptoms of the disease, respectively. In the current study, only 6.9% knew the prevention mechanism of anthrax in humans, of these 2.7%, 3%, 1.5%, 1.5% and 0.3% of respondents mentioned burn anthrax suspected carcasses, avoiding skinning anthrax dead cadaver, avoiding contact with anthrax infected animals, avoiding eating anthrax infected animal products and animal vaccination, respectively. Regarding to professionals, 82.7%, 75%, 73.1%, 69.2% and 50% of respondents mentioned avoiding skinning anthrax dead cadaver, burn anthrax suspected carcasses, animal vaccination, avoiding contact with anthrax infected animals and avoiding eating anthrax infected animal products, respectively. Professionals were having good knowledge than livestock owners, this might be due to experience of handling anthrax cases and had better access to information of the disease.

Most animal owners who participated in this study thought that anthrax could be transmitted among humans and animals. Anthrax is not a contagious disease. It can't be transmitted from an infected person to a healthy person through the aerosol and ingestion route. Still, in some rare cases, the person-to-person transmission may occur with cutaneous anthrax, where discharges from skin lesions might be infectious. Likewise, according to OIE, it does typically not spread from animal to animal. Most livestock owners did not have sufficient information about the seriousness of anthrax around their surroundings; only 8.1% and 22.3% of respondents knew about human and animal anthrax seriousness, respectively. However, medical and veterinary professionals (almost all) have a good attitude towards the severity of the disease around their locality. This implies experts have not created sufficient attitude-altering tusks at a community level; there is a gap in knowledge transfer from professionals to community members. On the contrary, one recent study conducted in the Amhara region of Ethiopia indicated more than 67% of study participants testified that anthrax was a health problem of their community. On the other hand, similar survey done in Tigray and Southern Region disclosed about 9.8% and 22.9% community members taught that animal anthrax was a severe problem of their locality and 11.3% and 42% believed human anthrax was a problem in the study area [5,12,20,24].

In the current study, about 69% of respondents did not have appropriate information about animal vaccination in preventing anthrax in humans. Out of sixty nine percent, 14.2% of participants taught that animal vaccination is not related to anthrax prevention in humans, while 54.8% did not know whether it is helpful or not. A similar study in Northern and Southern Ethiopia (Tigray region) indicated only 32.4% and 47 of participants believed that vaccinating animals could help anthrax prevention efforts in humans, respectively. The current study disclosed that 91.3% (livestock owners) and 90.4% (vet and medical health practitioners) of study participants believed that eating uninspected beef/mutton with hot pepper sauce locally called "Daxa" could prevent them from getting sick. It could indicate excessive community dependence on herbs and spices, which they believed could prevent some form of infectious disease. Some other study done in Ethiopia and Ghana explained the presence of similar community belief, which reported that cooking meat or carcasses of an animal that has died of un-natural conditions with herbs could

prevent diseases like anthrax. The proportion of respondents that thought *Bacillus anthracis* spores in soil can pose a direct risk of infection for livestock was 100% (52/52). In comparison, 69.2% (36/52) had a negative attitude because they alleged that it could pose a direct risk to humans. It could be due to some professionals have difficulty remembering what they have learned at school in the past and a low level of commitment/engagement to update themselves through reading and gathering information related to the disease. In general, despite livestock owners and consumers had negative attitudes towards most anthrax prevention related tusks, but professionals had a good attitude [18,22,25].

In this study, almost all animal owners in the study area practice a free-range grazing system. It could be due to the study area situated at the lowland part of Zonal administration, where the grazing land coverage is higher compared with highland altitude areas. Hence, the free-range grazing practice most likely exposes an animal to *Bacillus anthracis* spores while grazing. The findings of this study indicated that about 34.9% of animal owners in Dugda Dawa District had a practice of vaccinating their animals against anthrax. However, most livestock owners in the district did not vaccinate their animals. Most of animal vaccine is available in Ethiopia and NVI entirely carries out its production. Vaccine delivery to communities and zonal administrations made through livestock bureaus and agencies of concerned regional states. Despite the fact that vaccines are provided at a minimal cost in the district, the vaccination achievement was not satisfactory. This could be due to low commitment of institutional leaders to avail all desired amount of vaccine for vet clinics and weak performance of experts to administer all planned dosage of vaccine to target animals.

Almost all of participants had a practice of using lime while burying the carcass. Previously, there was a recommendation to use lime for anthrax disinfection when burying an animal dead of anthrax. However, recent scientific work revealed that exposure of anthrax spores to calcium (calcium oxide) might help in their survival and viability, so it is not recommended to use lime for agricultural anthrax disinfection. Therefore, avoid use of lime while burying the carcass can be considered one of good community practice conducted by majority of respondents. Almost all (99.4%) of animal owners do not use personal protective equipment (such as glove and face mask) made from local material while handling the carcass of suddenly dead animals. It might be due to some practice or habits require some amount of ransom to be spent on PPE, such as goggles, gloves, and boots. However, having adequate knowledge and attitudes, individuals cannot convert these into practice due to financial constraints. The finding of this survey also indicated that PPE usage among professionals was also found to be very low. However, the proportion of medical workers using PPE was found to be better than animal health workers. This could be because there will be insufficient PPE supply by government bodies in veterinary care institutions, lack of willingness of professionals to use PPE, and absence of strict directive, which enforce PPE usage in the veterinary clinic or animal health post [26].

Amazingly, 90.1% of respondents had a habit of raw or undercooked meat consumption practice. It could be due to improper social and cultural tattoos that encourage consumption of raw meat in the form of "Kurt or Kitfo" is better than cooked one and the deeply established traditional habit of eating raw or undercooked meat throughout the country. This finding aligns with a previous study in Nazareth Town and Sodo Zuriya district, Ethiopia, which revealed Over 86% and 82.4% of the study participants had a habit of raw

or undercooked mutton consumption [22, 27].

Generally, consuming undercooked or raw animal products is a well-established risk factor for acquiring many zoonotic diseases, including anthrax in an area. Even though in Ethiopia, meat consumption amount is not adequate compared to the rest of world countries. However, large and small ruminants were sometimes butchered for the sole purpose of selling within the community. Moreover, on special occasions, in most parts of the country, people have a cultural ceremony of slaughtering an animal and sharing the meat among the group, called “Kircha,” which Ethiopians consider as their social capital. Some other previous studies explained that an unknown number of live animals sold for home slaughter and consumption purposes in the Ethiopian market. Even if most consumers, 93.5% didn't have a practice of home slaughter with their community members but 84.1% don't know meat had been inspected by veterinarians before being distributed to the public and 35.5% of participants uses meat bought from the street. This could be due to an inadequate level of community awareness on the importance of inspected meat over an uninspected one, and attitude of undermining the consequence of zoonotic risks. In general, most community practices were risky, that could impose public health hazards directly or indirectly, and the community practices found to be poor among the participants [28].

Conclusion and Recommendation

To the best of our knowledge, this is the first study to address the perspectives of livestock owners and professionals regarding anthrax in Guji zone. The study revealed that majority of the community members had idea about anthrax and its symptoms and transmission in animals. But about below half of the participants did not know the mode of transmission of anthrax, prevention measures, symptoms and its zoonotic nature. Livestock vaccination practice of the community is not good and most of the farmers did not show interest to vaccinate their animals. Most people continue to consume uninspected raw or undercooked meat, fail to vaccinate their animals, unable to use PPE, and embraces enormous risky cultural practices. Some practices of the community and professionals were significant risk factors for anthrax. Practices such as free grazing system, consumption of raw or undercooked meat, the experience of touching suspected dead body without appropriate personal protection equipment and improper disposal of the carcass are common within the communities of the study area.

In line with the above conclusion, the following recommendations are forwarded:

- Enhanced public health education and targeted interventions with one health approach should be applied.
- It is necessary to ensure increased public awareness on vaccination of the livestock population.
- Animal owners should ensure sick and or dying animals are not skinned, slaughtered or butchered for meat consumption.
- 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

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